Towards Long-Term Solvency of US Entitlement Trust Funds, I: How to Market Time Trillions

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Abstract: The regular specter of a potential US default on its sovereign debt, and the serious consequences it would have globally, forces a hard look at how the US manages its money. The Entitlement programs such as Social Security and Medicare now make up over half the US annual budget (52% in 2022), costing trillions of dollars every year, and rising. To pay for this, the US has set up various Trust Funds to stay ahead of yearly payouts. But, as is well-known, outlays are growing faster than deposits, with imminent collapse of the entire system envisioned by 2033-35. To head off the shortages, there are seemingly only two avenues available: increase targeted tax receipts, or reduce benefits (or a mix). But neither of these options is politically palatable. We offer a third option: to make the Trust Funds themselves work harder, by investing them in US capital markets. These Trust Funds have held trillions of dollars for decades in "risk-free" assets, earned a pittance, but now risk total insolvency. With better returns, one can bypass collapse to achieve solvency. This idea is not new, but the fear of major market downturns which could prove catastrophic has always stopped this line of thinking. This is where our proposal offers a game changer. For the first time, we propose to use an algorithmic trading method to invest Trust Funds in US capital markets. It is a method developed and tested in previous papers, and designed to both exceed market returns and reduce market drawdowns. This potential two-sided win can be the catalyst to finally make these Entitlement programs solvent for the long-term. As an exemplary result, we show that if the Social Security Trust Funds had been invested in the market since 1991 according to our methods, then even after paying benefits, the Funds would stand today at $6.2T, rather than the actual $2.8T. Going forward, bold action is needed to avert disaster and ensure solvency. While some adjustment of both tax receipts and benefits may be needed, sound investment can do the bulk of the work to save the program. While this concept is broadly supported by other informed observers, some believe it is too late to implement. Our thesis is that dramatic action can and must be taken now to save Social Security, as well as to foster decades of strong economic growth. But time is of the essence.

Keywords: social security trust funds; investment; trading; algorithm trading; market timing; buy and hold

1. Introduction

What is money in the case of a sovereign nation such as the US? Specifically, what is cash, debt, or an investment? This simple question is central to our subject. If it appears trivial, read on. As of November 24, 2023, the US national debt stood at $33.8T TreasD (2023), of which $7.1T is actually Intragovernmental debt, while the rest is public debt. Yes, the govt owes itself money (and pays interest)! The line between cash and debt is thin.

The national debt is over 100% of its GDP, estimated at $26.5T BEA (2023). As another comparison point, the total value of the US stock market - say the S&P500 companies, is $34.4T YC.1 (2023) (while the Wilshire5000 values at $42T YC.2 (2023)), and the size of all private retirement assets in the US is about $33.6T ICI (2023), so at present the total stock market, the GDP, all retirement accounts, and the national debt are all roughly similar in size. The US federal budget for 2023 was $6.13T TreasB (2023), or about 23% of GDP. But
the market and GDP are growing. The engine for all growth is of course private enterprise. The government can also avail of that engine for its purposes (e.g., save Social Security).

On 19 Jan., 2023, US Treasury Secretary Yellen declared that the US had officially hit its approved debt limit, and could not be certain to pay all the bills as they arrive. In this instance, it was resolved on 3 June, 2023, with a two-year suspension of the debt limit. But the regular specter of a potential US default on its sovereign debt, and the serious consequences it would have globally, once again forces a hard look at how the US manages its money. Though off the table this time in the negotiations, Entitlement programs such as Social Security and Medicare now make up over half the US annual budget (52% in 2022), costing trillions of dollars every year, and rising; they are the elephants in the room, a source of political tension. Nevertheless, at the end of September, 2023, US Social Security Trust Fund Reserves (SSTF Reserves for short), the largest of the funds, stood at $2.8T (same as at end of 2022, as net change in fiscal 2023 was only -$22B), a substantial amount. To pay for the benefits, vast earmarked tax receipts are deposited in them yearly; but these earn only modest interest (e.g., 2.35% in 2022), to stay ahead of yearly payouts; and even that return is illusory, since it just increases the US debt. But, as is well-known, due to changing demographics, outlays are growing faster than deposits, with an envisioned shortage looming, and which is then projected to grow out of control; see figure ?? As we will see, this is projected to crash the entire program as it stands in the next decade, so some drastic changes now appears inevitable.

In effect, these Entitlement programs, if unaltered, could even threaten to bankrupt the US government. Do nothing, and in ten years the benefits would by law be automatically cut by 24%, which would be devastating for millions of recipients. Yet despite its importance, there is very little literature on this topic. And among politicians, this topic is a minefield. It would seem that to head off the shortages, there are only two avenues available: increase targeted tax receipts, or reduce benefits (or some mix of the two). Neither of these options is politically palatable.

While not the first to do so, we offer a third avenue: to make the Trust Funds themselves work harder, by investing them intelligently in US capital markets. As a quick primer on trust fund equity investing, see Munnell (2023). In fact, this recent reference tackles the same topic we do, and serves as our direct comparator. "The real world provides a convincing case that governments can invest in equities in a sensible manner." Munnell (2023). It makes a strong case for equity investment of the SSTF Reserves, using existing models (in Canada, and US). Nevertheless, it concludes that the time has passed for this approach, arguing the trust fund is now thin, and time is inadequate for typical incremental investing. But we show the fund is not thin, and take a step beyond Munnell (2023) and all previous authors by using algorithmic trading to go in far more aggressively, while also reducing drawdowns. But no blind faith in algorithmic trading is needed, as we provide our trades explicitly in our simulations, allowing direct verification.

Under current law, these Trust Funds must be invested in special Treasury Bonds; for concreteness, we will focus on the Social Security Trust Funds: Old Age and Survivors Insurance (OASI), and the Disability Insurance (DI) Funds). But let us first dispense with a common myth - that the Trust Fund Reserves are actually bogus, a mere accounting trick. In fact, they are real obligations of the US Government, like all US debt obligations TPC (2023). The real problem is not that they are bogus, but that they don’t earn enough. In 2022, for example, these gave a return of just 2.35% SSA.2 (2023), while in 2021 it was just 1.4%. And even that return is just paper: the investments are in Treasury bonds, so the government pays itself (with debt)! As the SSA states in its 2023 study, for the past 12 years, it has noted that the Trust Funds will become insolvent and depleted sometime in the period 2033-2035. So some significant changes must be made. In effect, these Trust Funds have held trillions of dollars hostage for decades in so-called “risk-free” assets, earning a pittance, yet now risk insolvency of the entire Entitlements enterprise. Meanwhile, US equity markets, which have soared in that time, can offer better real returns than the paper 2.35% the government currently claims, though with obvious market downturn risks. There, of course, is the rub.
Note that US Senator Bill Cassidy (R-LA) has recently proposed an idea Cassidy (2023) to sequester $1.5T over 5 years, invest it in markets for 70 years, and then use the proceeds to pay Social Security. While we do not dwell on this proposal specifically, it gives a nice summary of how we got here, and suggests equity investing to stabilize the Trust Funds.

Figure 1. Congressional Budget Office 2023 Report on Budget and Economic Outlook, showing clearly that US Outlays have exceeded Income, and moreover, that Mandatory expenses such as Social Security and Medicare are the drivers of the Outlays. Figures Credit: US Congressional Budget Office, 2023.

Indeed, major market indices, such as the S&P500 (SPX) and Nasdaq (IXIC) can offer returns of nearly 10% - a real return from economic growth. With such, investing in the market could help alleviate the crisis, and achieve solvency. This option has of course come up many times over the decades Brookings (1999), MIT (2003), Brookings (2016), Burtless (2017), SSA.2 (2023), Munnell (2023). In fact, the Social Security Administration itself conducts studies on investing a portion of the Trust Funds in risk assets SSA.1 (2023); SSA.2 (2023), which we will examine herein. In fact, several countries (Canada, Japan, and Sweden) already invest part of their social security reserves in various equities. And importantly, a US Gov’t retirement program, the Thrift Savings Plan (TSP), already invests some assets in US capital markets TSP1 (2023); TSP2 (2023). Finally, a good portion of the $33.6T in total private US retirement assets are in fact in equities. So there is ample precedent. Why should the US Gov’t miss out on this growth?

But when it comes to the massive US Social Security Trust Funds, the real danger of major market downturns, called Black Swan events, which could prove catastrophic for these programs on which tens of millions depend, has always stopped this train in its tracks. The undeniable fact is that a major downturn, of say 50% or more, could happen at any time without warning. If it occurred right at the start of such a risk-asset investment program, its impact would be global, and unfathomable. It simply cannot be permitted. Note that if the monies were handled privately by millions of individuals, this would not be a concern (it is just the market!); this issue arises only because it is under one fund, and held by the government.

Thus, it seems any actual investment in risk assets for Trust Funds must initially be undertaken incrementally, gaining confidence with improving returns. This point was
already made and implemented, with linear increment growth, in simulations in Burtless (2017). (We envision a sigmoid-shaped increment growth.) Also, no previous proposal has even tried to blunt the effects of major downturns, as we do. Predictably, so far no has moved the needle on this debate. But could there be a way to get good returns and reduce the drawdown risks? Yes, by smart market timing! In three previous papers (Topiwala and Dai (2022), Topiwala-2 (2023), Topiwala-3 (2023)), we have addressed this precise problem. In short, there is a systematic way to both increase returns, and reduce drawdowns. That is a game changer.

The Entitlement programs are seen as sacred and untouchable. No politician wants to be seen as reducing benefits, and yet raising taxes (even on say high wage or wealth groups) appears for now to be politically out of reach. The third option is investing in equities for better returns. In this paper, we review some past and present proposals (by President Clinton PresClinton (1999), Brookings Institution Brookings (1999), Boston College Burtless (2017), and the SSA itself SSA.0 (2005), SSA.1 (2023); SSA.2 (2023)), but offer one major improvement, as mentioned. But before we elaborate on these ideas, there are at least two major obstacles to face, relating to politics and perception, which must be addressed to the satisfaction of all parties and the public.

There is only one rule in investing: buy low and sell high. And to achieve this, effectively two separate schools of thought have arisen to implement this idea in capital markets. One is "value investing," in which investments are made in individual stocks based on whether they are presently undervalued in the market relative to expected future cashflows. Warren Buffett is a key example of such an investor. The other approach is "technical investing," in which a risk asset is judged to be suitable if it is demonstrating upward momentum based on recent price action. But any way one looks at this, the first obstacle is that the notion a government agent (say a Trust Fund Czar), armed with trillions of dollars and selecting individual stocks to invest in, is preposterous. The government simply can’t be seen favoring some stocks over others; the politics of such an action would be beyond consideration. In fact, politics would appear to rule out any deliberate action on the part of a Trust Fund Czar; the czar would seem to be powerless.

One possible way forward is to invest directly in market indices (or, with trillions in hand, create the world’s largest investment funds that mimic indices). This point was also made in Burtless (2017). Let the market decide who the winners are. The government can stay above the fray, and sell this to the public as just investing in its people and industries. This would be a "Buy American" campaign on steroids. So far so good.

But now remains the other major hurdle: if the government can only invest in market indices (for concreteness, we consider SPX, IXIC, Russell2000, and Wilshire5000), then it must also suffer the major downturns of these indices as well. For example, both SPX and IXIC have suffered downturns in excess of 50% in their histories, even reaching 80%, and other major indices have had similar downturns. Again, such a catastrophe, already devastating for the economy at large, would be magnified if the government were also caught in it. Indeed, the government is the safety net of last resort in such times, such as in the aftermath of the famous 1929 Market Crash, where government interventions on a massive scale were a literal lifeline to millions. In fact, it was in the horrific aftermath of the 1929 Market Crash that the US government initiated the Social Security program in 1937, in an effort to never have to face such a situation again, investing billions right away even though the initial payments were in the low millions. Since 1983, it even switched from pay-as-you-go to prefunding the program, amassing large reserves since that provide a safety cushion. So if the government’s reserves were suddenly wiped out at the same time as the general economy was down deep, it would lead to a global disaster of unseen proportions. It is out of the question.

That is where unlike all other proposals, ours is innovative, and offers a game changer. We propose a smart market timing method to invest in US securities via major index funds, developed and backtested over decades, and presented in three recent papers (Topiwala and Dai (2022), Topiwala-2 (2023), Topiwala-3 (2023)). There we presented substantial
background on market history, typical investor as well as managed fund performance, and algorithmic trading methods suitable for our market timing needs. We showed strong evidence that, despite overwhelming negative opinion regarding even the possibility of successful timing, simple timing methods can be developed that can be effective in both outperforming the market as well as in reducing drawdowns. Please refer to our cited papers, available online, for extensive background and approach development. As a comparison point, while IXIC achieved a 10% annual return over the 40-year period ending 2022, it also suffered a devastating 78% drawdown in that period (namely the 2000 Dotcom Crash), along with several other major crashes. Meanwhile, our timed approach to investing in IXIC offers a dramatic 20% annual return, but limits the maximum drawdown to 40%. In short, twice the annual return, and half the maximum drawdown. That’s great. But can such results scale to this level?

Our published results are of course in the context of small investors, not the US Government. They do not apply directly to measurable fractions of the entire economy. How can one scale market timing to $Ts? This is a massive question, that needs a serious, in-depth answer. To make initial progress, in this first paper we make many simplifying assumptions, and work later to bypass them. With the size of the US Trust Funds, a switch from risk-free to risk asset investing cannot be done either quickly or easily; it must be phased in gradually and nonlinearly. Nor can simple market timing be applied on this scale. Moreover, unleashing trillions into capital markets could raise havoc if not done judiciously. This topic is thus much larger and far more intricate than can be covered in one paper. For simplicity in this initial paper, we postpone delving into this level of analysis, and assume that both the switch and market timing can be done instantly (on at least a portion of the holdings, and incrementing that portion), whether in the deep past, or starting today, to obtain the first, qualitative results with our innovative methods. Any results based on such gross assumptions cannot hope to be convincing. But it can aspire to be eye opening. In short, we want to leverage capital markets for greater returns, yet reduce the drawdowns they are subject to, all without disrupting the markets - a tall order. To get there, our guiding principles are graduality, nonlinearity, and impartiality.

With these caveats, we begin herein on a potential solution that might appeal to all sides. Our simulations show that had our method of investing in market indices been suitably generalized and applied to the SSTFs, they could be running healthy surpluses, providing secure cushions and protecting against future market downturns that are inevitable. Moreover, even going forward starting today (November, 2023), assuming market growth in the future remains qualitatively in line with the past 40 years, the trust funds would become solvent while continuing to provide the targeted benefits.

As noted at the outset, some observers believe it is too late now to invest in equity markets to salvage Social Security Munnell (2023), MunnellMW (2023). Again, Munnell (2023) is our key comparator. Authored by a noted observer in the field (Dr. Alicia Munnell of Boston College, Director, Center for Retirement Research), we quote its conclusion in full.

The notion of governments investing in equities through retirement program trust funds is a viable concept that has been proven feasible, safe, and effective in both Canada and the United States. So, in theory, this idea could work with the U.S. Social Security program. But one critical component is currently missing: Social Security no longer has a sizable trust fund to invest. And rebuilding the trust fund through additional taxes or borrowing may not be either wise or feasible. Thus, while the mechanics are totally manageable, the time may have passed for raising taxes enough to accumulate a meaningful Social Security trust fund that would make investing in equities worthwhile. Munnell (2023).

We fully agree, all except the last point – that the SSTF Reserves are nearing depletion, making it too late. We cite evidence that SSTF Reserves are still at $2.8T, same as at end of 2022, and very close to their all-time highs. (2023 receipts less payouts resulted in only about $20B change in the SSTF, less than 1%.) Sure, it’s debt (bonds), not cash. But it is real, just as real as all US debt obligations TPC (2023). We will give it the dignity it
deserves. And it is not near depletion, but near its all-time highs; see figure 2. Munnell (2023) discounts investing a debt in equities, because only the surplus over the nominal interest the debt earns would count. We beg to differ. That paper interest really is bogus as it further increases debt. But growth in equities is actual economic growth. Only real growth can help. To be clear, we do not advocate borrowing more just to invest in equities.

Furthermore, as all previous commenters only considered Buy-and-Hold investing of SSTF Reserves in equities, and only doing so incrementally (e.g., 2.67% per year Burtless (2017)), we also agree that it is too late either to invest that incrementally, or to use plain Buy-and-Hold investing. Having stalled for decades, much bolder action is needed now. But by our projections, based on more sophisticated investing methods that depend only on the US economy continuing to see growth at rates qualitatively similar to past rates, SSTF solvency can be achieved. Of course, the US economy may well fail to achieve the levels of growth that it has seen in the post-WW2 era, as a World Bank analysis suggests WorldBank (2023).

As a tech CEO, I see it differently. With democracy, a strong and diversified economy, an enterprising people, and worldwide technology dominance, to paraphrase Warren Buffet, it would be a mistake to bet against America. Much as England led the Industrial Revolution, America now leads the Tech Revolution (as the current artificial intelligence surge shows us). Tech growth can power wealth generation for decades, partly uncharted by history. Thus, regular, significant, and unbiased investment by the government in US capital markets may help stabilize them, reduce the likelihood of the deepest downturns, burnish their appeal to investors worldwide, and even improve their growth rates by hypercharging them. In short, the door remains open in our view. Yes, we suggest dramatic action, modifying the way both our government and industry are run. We make no comments on its political feasibility, but simply show the way. We see it as not only the way to save Social Security, but to foster decades of strong economic growth into the future. But time is of the essence.

In sum, we contend that (1) equity investment is key to salvaging Social Security; (2) it is not too late; but (3) we now must be very aggressive, go in much faster, and use elements of algorithmic trading to control loss.

The rest of this paper is organized as follows. We will assume some familiarity with our previous development, but for reader convenience, Section 2 repeats some material from our previous papers to provide the pertinent background, market history, our simulation framework, investment performance metrics (including key new ones!), and some key prior results. Section 3 presents some background on proposals to invest Social Security Trust Funds in equities. Section 4 presents our new results in investing historical Trust Fund resources in market indices using our timing algorithms. Section 5 presents preliminary conclusions from our analyses. Our results are presented in easily interpretable graphical form, showing strong performance curves versus the Buy-and-Hold (BnH) method, as well as the reduced drawdowns over time.

2. Investment and Market Timing Essentials

In this section, we rapidly review the core tools we need for our analysis, as well as some necessary contextual information. These concepts were developed in the context of individual investing; please see our previous papers for more details and background. We will consider ways that they can be generalized to US Gov’t Funds in later sections.

2.1. Investment Basics

There is only one rule in investment: **buy low and sell high**. However, there are a number of ways to try to achieve this, and two distinct styles have emerged. **Fundamental analysis** aims to understand companies from an operational and cash flow point of view, computes a present value of future cash flows to arrive at a fair (intrinsic) price, and makes buy or sell decisions based on the difference between the computed and actual price.
In contrast, **technical analysis** generally studies the price history of its shares and the market to derive signals for when to buy or sell a stock [ChartSchool (2022)].

Both of these methods are successfully used in the market. Yet fundamental analysis involves stock picking, which is less applicable in our context. We will work with technical analysis. We also note that there is a third method we can compare these with, in which an investor can simply buy and hold a security or index (buy-and-hold, hereafter referred to as BnH).

### 2.2. Market Timing Background

Market timing is an approach to trading based on determining when to buy or sell a stock; this can be done by algorithm, or by other methods. In a sense, all approaches to trading can be viewed as timing.

We remark that much of the published literature has been strongly skeptical of market timing as even a possibility (Damodaram; Graham and Harvey 1994; Henriksson and Merton 1981; Merton 1981; Sharpe 1975). However, there have been some countering voices Chen and Liang (2007), which confirm its effectiveness.

Moreover, in three previous papers Topiwala and Dai (2022), Topiwala-2 (2023), Topiwala-3 (2023), we developed a simple and effective timing method, based on so-called moving averages, which is suitable for both professionals and small investors aiming to grow wealth over long periods of time (decades). We achieved powerful results in trading US-based market indices, well-known stocks, and US sector funds. We now take the first steps to scale the concept to the SSTF Reserves ($Trillions).

### 2.3. Market History

It is important to understand the conditions in which market timing systems such as those we propose can be successful.

1. Markets have long-term trends, which are generally up.
2. They have periods of downturns as well, which can be protracted.
3. They also have some rapid plunges (e.g., Black Monday).
4. They may even have some self-similarity properties at different scales (a point we mention, but do not explore).

We mainly utilize item (1), while (2) is just a special case, (3) is a feature that we have to deal with, and (4) is a sidelight we ignore, but which may be amenable to multiscale analysis Topiwala (1998).

As noted in our previous papers (see figure 1), the three main US-based market indices, DOW, SPX, and IXIC, have had a remarkable history of growth (the first two for about 100 years, the last about 50 years). The growth of the economy and of stock prices are of course the fundamental force behind all investment. Will these trends continue, and at a similar pace? The future is unknown, and it may not be similar to the past. There are numerous analyses that suggest that future growth will be slower than in the past; we cite a comprehensive 2023 study by the World Bank [WorldBank (2023)]. We will comment on this important point later. For now, we will limit to backtesting on market history, and leave future simulations to follow-on papers.

### 2.4. Simulation Setup

To make progress, in the context of individual investors, we formulate a concrete simulation setup and goal for our investment studies.

**Simulation setup:** Start with $1K, allow leverage, model interest rate as 3%, and track the performance of a timing algorithm vs. an underlying variable (buy-and-hold) for a period of time (e.g., decades, for example, 20–40 years).

**Goal of market timing:** To meet or exceed an investment’s buy-and-hold performance, while limiting its maximum drawdowns (e.g., to <50%, or even <40%) over the investment time period.
2.5. Market Performance Metrics

The first and most obvious indicator of performance is simply to graph the growth of an investment over time, as well as to compare several of them. However, if two investments, say A and B, have similar growth but one is more volatile than the other, an investor would naturally prefer the less volatile one. The Sharpe ratio, developed by the 1990 Nobel Prize-winning economist William F. Sharpe (Sharpe 1994), is the excess return of an investment (over a risk-free one), divided by the volatility of the investment, measured as the standard deviation of the excess return, when measured in increments of time (for example, daily returns). In practice, the Sharpe ratio is computed using the expected value of the excess daily return of the asset, divided by the standard deviation of the daily return. Furthermore, it is common practice to treat the risk-free rate as zero.

\[ \text{SharpeRatio} = \frac{(R_p - R_{rf})}{\sigma_p}, \]

where \( R_p \) = portfolio return, \( R_{rf} \) = risk free return, \( \sigma_p = \text{std of portfolio} \).

First compute:

\[ \text{dailyReturn} = \frac{(P_i - P_{i-1})}{P_{i-1}}, \quad \text{for} \quad i > 1. \]

Set \( N = 252 \) = num trading days/yr.

\[ \text{dailyExcess} = \text{dailyReturn} - \text{dailyRiskfree}. \]

\[ \text{SharpeRatio} = \frac{\sqrt{N} \times E[\text{dailyExcess}]}{\text{std(dailyExcess)}}. \] (1)

One known problem with using the standard deviation to capture volatility in the Sharpe ratio is that it penalizes the upside as much as the downside variability, which is contrary to investment objectives (a defect fixed by the so-called Sortino ratio). For completeness, we also mention another useful measure, the Treynor ratio (Treynor and Mazuy 1966), whose numerator is the same as for the Sharpe ratio, but the denominator is the beta of the portfolio (defined as the ratio of a covariance to a variance \( \text{Cov}(R_p, R_{rf})/\text{Var}(R_p) )\).

A number of papers and blogs discuss the use of both the Sharpe and Treynor ratios (plus scaled versions), for example, to measure the hedge fund performance (van Dyck 2014). For now, we stay focused on the well-known Sharpe ratio as a comparator.

Note that an initial investment of \( I_0 \) dollars, with an annual rate of return \( r \) over a period of \( M \) years would give:

\[ I_M = I_0(1 + r)^M. \]

This implies \( r = \exp((1/M) \times \ln(I_M/I_0)) - 1. \) (2)

In addition to gains over time, an investment also has drawdowns (relative losses) from time to time, and we are especially sensitive to the maximum percentage drawdown, MaxD, over an investment period. Thus, two important measures for an investment are the annual return (AnnR), and the maximum drawdown (MaxD). Using this, we introduce the ARM Ratio = ARMR = \( \frac{\text{AnnR}}{\text{MaxD}} \). It has elsewhere been called the RoMaD (Chen 2020).

In addition, we define Co-MaxD as \( (1 - \text{MaxD})\), and define a second, more powerful measure: the Product of Annualized Return and Co-MaxD, PARC = \( \text{AnnR} \times (1 - \text{MaxD}) \). We have shown in previous papers that our measures ARMR and PARC are superior to capturing the value of investments better than Sharpe, with PARC being the best.

\[ \text{ARM Ratio} = \frac{\text{AnnR}}{\text{MaxD}}. \quad \text{PARC Measure} = \text{AnnR} \times (1 - \text{MaxD}). \] (3)

**Investment objective:** In our view, the objective of sound long-term investment is to simultaneously maximize the annualized return (AR) and minimize the maximum drawdown (MaxD) over the period of investment; that is, to maximize the ARM ratio (ARMR), or better, to maximize the PARC measure.
of the excess daily return of the asset, divided by the standard deviation of the daily return. And it is common practice to treat the risk-free rate as zero.

Figure 1. A remarkable century of markets and growth, even through the Depression and World Wars: (top) 105 years of the Dow; (middle) 95 years of the S&P500; (bottom) 51 years of the Nasdaq index; data from (macrotrends 2022).

Figure 2. A remarkable century of markets and growth, even through the Depression and World Wars: (top) 105 years of the DOW; (middle) 95 years of the S&P500; (bottom) 51 years of the Nasdaq index; data from (macrotrends 2022).
2.6. Rule-Based Trading Using Moving Averages

One simple market timing approach is in fact well known in the industry and involves the use of the so-called weighted moving average, WMA(N), the weighted average price of a stock or index over the past N trading days. Starting from a given day, labeled Day 0, count backwards up to \( N - 1 \) days and average the price on those days, with weights

\[
WMA(N) = \sum_{i=0}^{N-1} w_i P_{-i}, \text{ where } P_{-i} = \text{price i days ago;}
\]

where \( w_i > 0; \text{ and } \sum_{i=0}^{N-1} w_i = 1 \).

As a special case, set

\[
w_i = \lambda^i / \sum_i \lambda^i, \text{ where } 0 < \lambda \leq 1.
\]

If \( \lambda = 1 \), get simple moving average \( \text{SMA}(N) = (1/N) \sum_{i=0}^{N-1} P_{-i} \). (5)

More precisely, the exponential moving average (EMA) is an infinite sum going back, where \( \lambda = 1 - (2/(N + 1)) \). We will mainly use the SMA for our elementary analysis. Now, a very simple and well-known indicator based on the SMA is as follows. Let \( S \) and \( L \) be two positive integers, \( S < L \), and consider \( \text{SMA}(S) \) and \( \text{SMA}(L) \). For example, one can set \( S = 50 \) and \( L = 200 \) and consider the 50-day and 200-day simple moving averages. Our indicator is the difference.

Algorithm 1: \( \text{Ind} = \text{SMA}(50) - \text{SMA}(200) \). If \( \text{Ind} > 0 \) be in, else be out.

Algorithmic trading in general is covered in hundreds of sources, for example the books Chen (2009), Donadio (2020). This specific algorithm has been well-known for decades, and is mentioned for example in Investopedia (2021) and Fidelity (2023). In fact, the Fidelity post Fidelity (2023) of June, 2023, has even declared that we are in a new bull market, based on such an analysis. While this is just one prototype trading algorithm based on moving averages, our tests show this particular one only has a modest performance in actual trading. While using two time periods is standard in algorithmic trading, this is not a limitation; three are used in Qinsti (2023), while Vecv (2023) employs up to six time periods (3, 8, 20, 50, 100, and 200 days) to read the market trend at multiple scales. Based on this core concept, we have developed an elaborate system, building a suite of over 20 individual trading algorithms, each using a decision logic based on conditional statements with inequalities utilizing up to four moving average periods, each an elaboration of Alg. 1. These can be further refined based on a variety of discrete parameters (such as the specific moving average periods, etc.), to create a suite of over 1000 individual trading algorithms, which we call FastHedge. In previous papers, we were able to obtain a stunning 20% annual return, far exceeding the market, with a maximum drawdown of 40%, well below market drawdowns, over a period of 40 years (ending in 2023). We use these same methods in our simulations here.

3. Prior Proposals To Invest Trust Funds in Equities

3.1. Academic and Institutional Studies

"Early in this century, being old meant being poor. When President Roosevelt created Social Security, thousands wrote to thank him for eliminating what one woman called the "stark terror of penniless, helpless old age." Even today, without Social Security, half our nation’s elderly would be forced into poverty. Today, Social Security is strong. But by 2013, payroll taxes will no longer be sufficient to cover monthly payments. By 2032, the trust fund will be exhausted and Social Security will be unable to pay the full benefits older Americans have been promised. The best way to keep Social Security a rock-solid guarantee is not to make drastic cuts in benefits, not to raise payroll tax rates, not to drain resources from Social Security in the name of saving it. Instead, I propose that we make an historic decision to invest the surplus to save Social Security. (Applause.) Specifically, I
propose that we commit 60 percent of the budget surplus for the next 15 years to Social Security, investing a small portion in the private sector, just as any private or state government pension would do. This will earn a higher return and keep Social Security sound for 55 years.”


While America’s commitment to prefunding Social Security was already underway in 1999, the SSTF Reserves have further ballooned since then; see Figure 2. Yet to go from this historic commitment and healthy reserves to imminent insolvency by 2035 as projected today SSA.2 (2023) amounts to a stark failure of policy. This must be remedied, fast. Millions depend on these programs. And following Pres. Clinton, it is appropriate to consider investing in securities as among the tools to use.

Echoing the president, the Brookings Institute gave Congressional testimony in 1999 Brookings (1999) which advocated for investing SSTF Reserves in equities as a way to improve its finances. This was followed up with a 2016 paper Brookings (2016) which showed that if partial investment of SSTF Reserves in stocks (at 40% level), if begun say in 1984, the reserves would grow nicely to have a Trust Fund Ratio of 4.1 by 2015 instead of the actual 3.1; here, the TF Ratio is the reserves over yearly outlays. Their simulation also includes an incremental buildup to 40% equity over 15 years, linearly at a rate of 2.67% a year. A second, Monte Carlo simulation looking forward, 2015-2090, they projected that a mixed stock/bond portfolio would remain solvent, with a TF Ratio of 3.1 in 2090, while the bond-only fund would become insolvent by then. Furthermore, they suggested that Trust Fund Reserves be invested in a broad market index, specifically naming the Wilshire5000 index Brookings (2016).

The Brookings paper was actually based on another collaborative paper with Boston College, 2016-2017, on the same topic Burtless (2017), which contained a more detailed study and provides a more defensible case. In their models, they used both the Wilshire5000 index (which dates back to 1971), as well as the Ibbotson Large Cap Index which is used to estimate the Wilshire5000 back to 1929 (using more recent correlations between the two indices). They used the same setup (40% equity limit, 2.67% increment per year). With this setup, they derive a variety of interesting and provocative results, both covering the past, 1929-2016, as well as looking 75 years ahead, up to 2091. As an example, in their 75-year forward-looking study, assuming partial and incremental equity investment begins in 2017, they asked for what fraction of Monte Carlo simulations did the SSTF Reserves reach insolvency (TF Ratio < 1.0), or exhaustion (Reserve=0). For mixed investing, 22% of runs reached insolvency, and 10% reached exhaustion. For bonds only, it was 95%, and 52%, a stark difference; see figure 3.

We remark that aside from these references (and the gov’t studies below), there appears to be almost no literature at all in this whole topic, despite its importance. Moreover, neither of these studies considered any further avenues than simple index investing. In particular, it seems no one have ever considered an algorithmic trading method to investing the SS Trust Funds; however, such sophistications are almost certainly in use in investing private trust funds, which today hold even more money than these government trust funds. This dichotomy is frankly surprising.
Figure 3. Results of forward-looking Monte Carlo simulations by Boston College, covering 2017-2091, for Social Security Trust Funds, considering both Mixed 40% Stock/60% Bond, and Bond-only investing. As expected, their results show that the percentage of Monte Carlo simulations that result in either trust fund insolvency or outright exhaustion is much higher for Bond-only investing (current practice) vs a hypothetical Mixed Stock/Bond portfolio. These favorable results are obtained merely by doing equity investment in tiny 2.67% per year increments, and with a maximum of 40% stock. Data from Burtless (2017). We expect even better results with more aggressive investing and market timing.

<table>
<thead>
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<th>InvestType</th>
<th>Insolvency</th>
<th>Exhaustion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed (40/60)</td>
<td>22.00%</td>
<td>10.00%</td>
</tr>
<tr>
<td>Bond Only</td>
<td>95.00%</td>
<td>52.00%</td>
</tr>
</tbody>
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3.2. Social Security Administration Studies

To be sure, the Social Security Administration, as well as other government agencies and special councils, have conducted their own studies and proposals for possible equity investment of the SSTF Reserves, and especially since Pres. Clinton requested ideas to make Social Security solvent. First we present the historical context. Figure 2 already gave some valuable historical context of Income, Cost, Net, and Reserves, 1957-2022. Even as of end of Sept., 2023, the SSTF balance was $2.8T, a substantial value that can begin to earn real income by our methods. But that opportunity is vanishing quickly.

Every year, the Social Security Administration conducts a 75-year projection of Income, Costs, and Reserves. For the past 12 years, it has projected that the Reserves will reach insolvency before 2035 (that is, it will not be able to meet costs at current benefit levels). It is projected that the Reserves will then be exhausted fairly rapidly; see figure 6. In SSA lingo, this is expressed as the quotient of the Trust Fund Reserves to the yearly payout, called the TF Ratio; thus TF Ratio < 1.0 means insolvency, and TF Ratio = 0 means exhaustion.
As mentioned, the SSA has also studied investment in equities, in a variety of proposals. For studies based on 2022 Trust Funds Reserves and going forward, their most aggressive proposal is to invest up to a max of 40% of the Funds in equities, similar to other studies, incremented gradually, and assuming that they can get a 5.8% real return on investment (that is, after inflation), they still get essentially no change in the outlook... the Fund still goes to exhaustion in 2035; see figure ???. This result may seem hard to understand in light of our studies in the next section and other studies, but it is really due to incremental investment.

Interestingly, the SSA’s explanation for this poor outcome is inscrutable, and steeped in gov’t-speak. We quote their report verbatim: “A change in the investment of trust fund reserves to include some equities affects the size of all summarized measures because increased ”present-value” discounting reduces the weight on values for more distant future years. As a result, the magnitude of the current-law actuarial balance and the summarized effects of most proposals is reduced. Therefore, the size of the change in the long-range actuarial balance indicated here cannot be interpreted directly as a reduction in the shortfall. The actual reduction in the shortfall from equity investment depends on the amount of reserves that are available for investment throughout the period. For example, if provisions to change revenue or scheduled benefits resulted in a purely pay-as-you-go system (reserves just above zero throughout the period), then investment in equities would have no effect on the actuarial balance.” SSA.2 (2023).

In terms of concrete critiques, first, rather than work with inflation-adjusted gains, since future inflation is unknown, it seems better to ignore inflation and work in current dollars (as we do below). Secondly, unlike for individuals and businesses, the US Government itself has no tax liabilities on income. Finally, if the entire system has been projected to go to bankruptcy for twelve years running, then incrementalism must go. As the SSA has already made plain, the current path is unsustainable.
Figure 6. Seventy-five year projection by the SSA for the SSTF Reserves, with incremental investment in equities, up to 40%. This simulation assumes a 5.8% real return above inflation, but still envisions near-term insolvency and then exhaustion, roughly around 2035. Due to the incremental investment, limitation to 40% max, and starting only after 2022, the conclusion is that such a late and slow start would make no appreciable difference at all in projected insolvency and exhaustion of funds. Figure Credit: US Social Security Administration, 2023 SSA.2 (2023).

4. Our Proposal To Invest Trust Funds in Equities

A key difference between previous proposals to invest SSTF Reserves in equities and ours is that for the first time, we are proposing to apply elements of algorithmic trading to the problem, whereas apparently all previous proposals only considered Buy-and-Hold (BnH) of securities. In fact, some 80% - 90% of all trades in the US equity markets are done by computers algorithmically, for good reason, trading trillions every day. And trillions more, held in private trust funds also often use algorithmic trading. So it is not a novel idea to consider it also for the SSTF Reserves. The real issue here is that in this case, a single "agent" - the Trust Fund Czar as it were - is trading a massive fund, rather than millions of individuals and professional traders acting independently, which comprise the market.

To meet this challenge fully, we must apply our mantra of graduality, nonlinearity, and impartiality. We first meet the challenge of impartiality fully by investing in all publicly traded companies, which we hereby model by trading the Wilshire5000 index (as was done by other authors as well). The graduality and nonlinearity aspects are far more intricate, and will be postponed to later papers, so that we can get the first qualitative results.

As observed earlier, unlike all other investors who work with more modest amounts, moving trillions of dollars in and out cannot be done quickly or easily. But there are many ways to deal with this. In effect, the TF Czar has to also act like the market. Thus, we may divide the fund into thousands to millions of much smaller buckets, trade them individually just as individuals would, staggering them in time for example. Many other such methods can be formulated as well, which would dramatically reduce the market moving impact of trading an entire trust fund at once. Also, some payees into the program (typically younger ones!) may have a greater risk tolerance than others (e.g., those near retirement); so their tax receipts can perhaps be invested first, for example. Again, we postpone such fine-grained analysis for later, and focus on trading the full fund, but in an elementary way. But we do place some serious restrictions on our method now that will help us later transition to an executable approach.

- While in previous studies we utilized both leverage and shorting the market to achieve powerful trading results, in this context, we forego both of these.
- We choose to always be long the market, but only scale in the range [0.4, 1] times cash in the market (Wilshire5000), and even [0.5, 1].
- While in previous studies we used up to about 20 trades/year, here we limit to approaches that greatly reduce the number of trades.
In our simulations to follow, we consider the 32 year period, 1991-2023 (1991/05/24 - 2023/05/26). We use only 22 trades in the entire 32 year period - less than one per year on average; and these were selected by algorithm, not by hand. Moreover, we made NO changes to the algorithms that we had developed for trading in individual accounts, nor even the hyperparameters. Indeed, we applied our FastHedge algorithm suite *as is*, just to get a quick idea of what we could obtain. We find the results very encouraging.

We tested two scenarios. In the first, figure 7, we invest just the initial SSTF Reserves in 1991 into the market according to FastHedge (FH), perform our trades, and compare against Buy-and-Hold (BnH). We obtain an 8.13% annual return, vs. 7.88% for BnH. While that is a useful gain, the real point is that with our 22 trades over the 32 year period, we have a maximum drawdown (MaxD) of only 31%, while BnH has a MaxD of 56.6%.

That is the whole point. A drawdown of 56.6% would devastate the entire enterprise, while as our graph shows, a 31% drawdown is far more manageable. And we can expect markets to continue to face deep drawdowns on the order of 50% or more. That is why the government must take advantage of active trading (with algorithms), just as nearly all professional investors in the market already do. We remark that in figure 7, the first graph shows the growth of the initial investment in FastHedge vs. BnH, which is smoother. The second graph shows the actual trades (22 total), the third shows the places where trades were made (blue means 1x in, red here means 0.4x in). Finally, the fourth graph shows the drawdowns, which have been kept powerfully suppressed by our trading method, and quickly disappear when we reach new local highs.

In the second test, figure 8, where similar comments as above apply, we also add the yearly net income added to (or subtracted from) the Reserves, being careful to subtract out from the net influx the yearly interest income “earned” from the US Treasury Bonds as recorded by the SSTF accounts. We have already remarked that these interest earnings are actually just paper (one hand paying the other), so we ignore them. By contrast, in our approach we are actually investing government trust funds in private equities, to obtain real returns, earned from actual growth of the economy. We note that we are working with constant dollars and not subtracting the rate of inflation. We now obtain an annual return (AnnR) of 10.23% with respect to the initial investment, and more critically, with a MaxD of only 31.35%, which as the graph shows is quite tolerable. The ending SSTF Reserves under FH trading (with just 22 trades in 32 years) are $6.2T, vs. the Actual $2.8T, a massive surplus. In effect, the Reserves would have grown to match the entire US budget, and 14.7% of the value of the Wilshire5000. Long before this happens, of course, Congress would stop feeding it and find other uses of this massive surplus. (We would not expect to reach even 10% of the Wilshire5000 value.)

Note again that with the actual trades explicitly shown in our figures (graphed as both position changes, as well in the index price history, where blue means a long position and red means short), any reader can verify our performance results directly. What is remarkable is that these trades were decided by a simple algorithm. And working well for 22 years, through several major market downturns, gives us strong encouragement that it can be successful going forward as well. Of course, these results are preliminary, and as mentioned, amounts this large cannot be moved in/out of markets instantly. In reality, our step function trades will need to be converted to smooth, nonlinear sigmoid-shaped trades over time, which can be achieved in several ways, for example by splitting the fund into millions of smaller buckets and staggering their individual trades in time. Again, such fine-grained analysis is postponed to later (but hinted here lest the reader despair that this method can’t ever be made workable). These results are suggestive that smart management of SSTF Reserves can result in both more powerful growth, and reduced drawdowns.

In fact, for this last simulation, we even restricted the range of investment to [0.5, 1.0] times cash in the market: we are always at least half in. This assurance in the marketplace, that the US Government will remain steadfast in its investments, and invest further consistently every year, if properly advertised and well-known, can actually help stabilize the markets in the first place, while burnishing their appeal worldwide. If investors know that
the Government is backing industry so robustly, there would be far less reason to panic and withdraw everything, as occasionally happens. It is total panic that can send markets down 50% and even 80%. We can alleviate the panic. This works to soften drawdowns. Indeed, even the Great 1929 Market Crash could perhaps have been avoided!

Yes, the SSTF Reserves growth curve, figure 9, is now no longer as steady as for the current approach; it now has ripples in it. The actual market had many pitfalls along the way, with a maximum drawdown of 56.6%. But we survived it, and profited! Again, all the benefits are fully paid, and yet the SSTF Reserves grow to $6.2T, and would grow further. By contrast, in the current approach, even with the $2.8T in Reserves, it has been consistently projected in every one of the last twelve years of government studies to default and disappear by 2035, forcing drastic changes to the Entitlements program.

Make no mistake. A dozen years of careful government studies has already made it plain. Something has to change. The current course is unsustainable. Raise taxes, reduce benefits, or make the existing reserves work harder. The first two choices have been debated, and there is no political appetite for them. Only one choice actually remains; better management of the Reserves. Why should the US government not avail of what every smart trader in the market has already been using for decades? Improve returns, and reduce drawdowns by algorithmic trading. Our preliminary tests are hardly definitive or conclusive. But they do point to the very real possibility of doing better; much better.

It has been known for decades that Buy-and-Hold is not a good trading strategy for any investor: individuals, professionals, or even Governments. All can benefit from better timing approaches. And even the simplest ones can be of great benefit over Buy-and-Hold. Moreover, with some elaboration, they may even be sufficient to save a massive Entitlement program from bankruptcy. In the process, it can make both the Government, and marketplace, more profitable and stable.
Figure 7. FastHedge investment of just the initial Reserves in 1991, versus Buy-and-Hold of those initial reserves, if invested in an index fund tracking the Wilshire5000 index.
Figure 8. FastHedge investment of the initial Reserves in 1991, plus the net yearly income (or loss), explicitly not counting the theoretical investment income from Treasury Bonds, versus Buy-and-Hold of those initial reserves, if invested in an index fund tracking the Wilshire5000 index.
Figure 9. Summary graph of Actual Social Security Trust Fund Reserves (yellow), vs FastHedge invested Reserves (green), 1991-2023. Note that despite the massive 56% market drop in 2008 due to the Financial Crisis, our invested funds survived, and profited. The strength of this investment growth would ensure the future solvency of the Social Security Trust Funds. This should be solid evidence investments can grow reliably despite major market downturns.

Again, just investing SSTF Reserves in the Wilshire5000 index as BnH would certainly generate nice returns also, but only after undergoing intermediate losses of 56.6%, which is totally unacceptable. That is why a method of alleviating those losses is necessary. We now quantify the gains we get over that simple Buy-and-Hold (BnH) method with our method. In this instance, all our advanced metrics are aligned (ARM Ratio, PARC Ratio, and Sharpe Ratio). Of course, we feel our PARC Ratio is the most credible of the three. One point we clarify is that in the last column, the annual return (AnnR) is measured against just the initial (but sizable investment), and does not take into account the yearly contributions as well, so it is not accurate. But critically, the real gains are in controlling losses (the Maximum Drawdown), which are fully accurate, while also getting some useful performance gains. See our summary results in figure 10.

We do not make future projections with Monte Carlo simulations at this time (but see figure 3). But if the next 32 years are qualitatively similar to the last 32 (and the past 100 years have been), then we can expect similar rates of growth and profitability, not just solvency. But to achieve such a sound future for Social Security, we need a method for incremental investment, and for BnH. The only way to achieve solvency now is to go bold; for example, invest 25% in year 1, and then 20% each year till in full. Our approach involves risk, but risk is already unavoidable. To make this bold approach work, Congress would have to bear the burden of the short-term risk until assets grow to about 3X yearly costs. From that point on, our methods should be steady and secure.

Figure 10. Summary table of gains by investing the SSTF Reserves in the Wilshire5000 index, during 1991-2023, according to our advanced performance metrics. Investing in FH with initial reserves and yearly contributions (less earned interest) provides the best results according to all our metrics, although we view the PARC Ratio as the most reliable.
5. Conclusions

In this paper, we employed an elementary form of algorithmic trading, namely rule-based market timing using moving averages, to achieve strong results in total US-based stock investment (Wilshire5000) over long periods using the vast Social Security Trust Funds. We showed that if full investment had begun in 1991, then despite a number of very strong downturns (especially the 56% 2008 Financial Crisis), the SSTF Reserves would have ballooned to $6.2T today, instead of the actual $2.8T, and be comparable to the entire US budget, putting the program on a very strong footing. We emphasized that in this simulation we did not use incremental growth of market investment, but plunged in headlong; its important refinement to a more realistic approach is a topic for follow-on work. But we can be assured that long before Reserves reached this size (nearly 15% of the stock market), Congress would stop feeding it with payroll deposits, and start using the surpluses for other expenses. Note that with the 40% max investment limit as used in previous studies, the Reserves would have stayed well below 10% of the market.

Likewise, going forward, we are at a critical juncture in the system. The last twelve years of SSA simulations have predicted the imminent collapse of the program in the timeframe 2033-2035. Something has to change. Despite a decade plus of warnings, no administration has made any changes: either raising taxes, or reducing benefits. Both of these choices are politically unpopular. It seems that the only feasible way forward is to make the money itself work harder. Fortunately, that seems doable, as our simulations (in concert with other published results) show. But the time has passed to do this incrementally, or to use simple buy-and-hold investing. The SSA’s own simulations show that incremental investment now would have virtually no effect on the imminent collapse. So all other avenues have been closed off. We suggest the only avenue remaining: invest more aggressively, and use smart market timing. Developing a more aggressive but still realistic approach to investing in equities remains to be developed, in follow-up work.

These are just preliminary thoughts and results. Many questions remain, both financial and political. In our opinion, injecting trillions into the stock market would indeed change the market, and there can be no pretense otherwise (as the MIT study MIT (2003) already cautioned, though Burtless (2017) suggested that at under 10% of the market, its effect could be negligible). But would that impact be necessarily negative? Would it upend company boards and distort markets? While that is obviously possible if not done judiciously and impartially, a strong case can be made to the contrary. A consistent US Government investment in the market could even be a great boon, boosting confidence for all investors, domestic and foreign, and stabilizing its trajectory. These ideas are untested and certainly speculative, and much work remains. However, we once again note that a dagger hangs over the entire Entitlements enterprise. Our follow-up work will have to analyze not only the impact of equity investing for the Trust Funds, but for the overall market itself. Here, our mantra has to be graduality, nonlinearity, and impartiality.

In this paper, we used just the simplest ideas in market timing, and showed they could be effective, even at the scale of SS Trust Funds. Of course, any trading algorithm can be improved, or be defeated by a well-contrived time series designed to test its failure modes. All trading algorithms have decision boundaries, and markets that straddle those boundaries will dissipate performance. Real markets are likely to test any and every decision boundary over time. The challenge is to construct decision algorithms that are both simple and generic, so its failure modes constitute a vanishing subspace of the space of possible trajectories of real markets. Moreover, investing in multiple variables and trading them individually can help mitigate the effects of markets testing any one decision boundary.

Thus, our work supports the thesis that effective market timing is not only possible but relatively easy, and requiring only a reasonable number of trades per year. We therefore push back on the long-standing notion that market timing is impossible. We also push back gently against the notion that it is too late to save the Entitlements program through smart investing. Certainly, valuable time has been squandered. But the future remains open.
The past 100 years have seen continued (though not consistent) growth, on a trajectory that seems remarkable. Will it continue, at a similar pace? No one knows. We have so far avoided Monte Carlo simulations going forward, as they may be of limited predictive value. Wide opinion suggests the pace of growth may slow. But the human enterprise has been challenged many times across history, by major events such as wars, famines, and disease, but persisted. The future is untold. But despite many serious challenges on the horizon, we believe our creativity may permit continued growth while reducing its negative impacts. As long as there is growth generally, our methods can help individuals, professionals, and even governments navigate financial markets to achieve strong results as well as constrain drawdowns.

Funding: This paper received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data sources for figures other than our results are cited in the paper. Our own results and figures rely on index and stock data widely available from many sources, for example, historical data from finance.yahoo.com (accessed last on 16 March 2023).

Conflicts of Interest: The author declares no conflict of interest.

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