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Does Fixed Income Buffer against Fraud Shocks?

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Abstract: Counterparty risk in the form of investment fraud damages a retiree's nest egg. Does fraud negatively impact portfolios that are both stock and bond-heavy equally? This study uses Monte Carlo analysis within the Trinity Study framework to determine the average reduction in portfolio success of a retiree who experiences fraud. Findings suggest that each incidence of fraud results in a loss of three percentage points in retirement success. However, portfolios containing some bonds (75/25, 50/50, and 25/75) outperform all equity (and all bond) allocations, particularly when fraud is present. On average, each incident of fraud reduces the chance the victim will enjoy a successful retirement by nearly 3%. Various limitations, implications, and future research possibilities are discussed.

Keywords: fraud; fraud shocks; retirement; portfolio success; Monte Carlo

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1. Introduction

In the mid-20th century when America's pension system began to fail (Marino and Melcher 2018), many scholars started investigating ways to smooth one's consumption over an entire lifetime (Friedman 1957). Over time, the retirement planning literature began analyzing retirement portfolio performance following aging shocks (Coile and Milligan 2009), health shocks (Liu et al. 2017), rate of return shocks (French et al. 2007), and price-consumption shocks (Alem and Soderbom 2011). However, there is no study that investigates the impact of fraud shocks on retirement. This paper contributes to the retirement planning and fixed income literatures by measuring the effect of fraud shocks on retirement portfolio success rates

Many of those defrauded are retired elders who suffer serious setbacks in their financial goals, notably retirement (Graham 2014). Liquidating retirement funds impacts the investor's tax situation as well as legacy goals (since all retirement accounts list beneficiaries on the application forms). Because there are contribution limits and other restrictions surrounding retirement accounts, investment fraud may disproportionately jeopardize those with sizable retirement assets. Therefore, it is important to locate fraud within the context of challenges to an investor's retirement plan.

The present study asks to what degree investment fraud negatively affects retirement portfolio success rates and whether incorporating fixed income into the portfolio helps buffer the effect of fraud. The purpose of the present work is to determine the magnitude of damage fraud wreaks on retirement portfolios. The paper's objective is to assess fraud damages across multiple retirement durations, magnitudes of fraud shocks, and asset allocations (stocks-to-bonds) to account for the uncertainty in which fraud will occur during retirement. This work hypothesizes that portfolios with at least some fixed income (75% bonds, 50% bonds, and 25% bonds) will help buffer the portfolio against fraud. Answering these questions requires looking to the literature for various metrics of retirement success and fallout caused by other types of shocks, from Bengen (1994) to the present.

2. Literature Review

2.1. Retirement Planning

Bengen (1994) wrote a seminal work on retirement planning using historical stock market return data, specifically the role of safe withdrawal rates on retirement outcomes. By introducing the concept of safe withdrawal rates—the rate at which a retiree can withdraw from their portfolio regardless of market conditions—Bengen (1994) concluded that 4% was the highest withdrawal rate that is completely safe from longevity risk.

Ibbotson et al. (2007) used both a 60% and 80% replacement ratio to calculate the effect of participant age on retirement outcomes. While taking inflation into account for higher-income earners who will need to "catch up" in their savings rates to obtain the desired post-retirement lifestyle, the authors concluded that successfully retiring at full retirement age (e.g., 65), one must begin saving no later than age 35 (Ibbotson et al. 2007).

Basu and Drew (2009) examined the viability of life-cycle funds, which begin with high stock allocations during a worker's accumulation period and slowly moves to bond-heavy portfolios as the worker nears retirement (also known as "glide paths"). Assuming a 9% savings rate, a 40-year horizon and a starting salary of $25,000 per year that increases by 4% each year, the authors concluded that glide path effectiveness is diminished by the portfolio size effect: Because the pre-retiree's portfolio is larger during bond-heavy years, the worker misses out on the higher gains of equity portfolios, resulting in less-optimal asset allocations (Basu and Drew 2009).

Schleef and Eisinger (2011) included foreign equities into the stock portion of a participant's asset allocation. They found that equity-heavy portfolios outperformed traditional life-cycle funds. Specifically, the authors designed reverse glide paths in which the bulk of the investor's retirement funds were placed in bonds to preserve capital in the early years when retirement assets were small. Over time, the portfolio invested more heavily in stocks to take advantage of the portfolio size effect mentioned in Basu and Drew (2009).

That same year, Wade Pfau, published three separate articles that sought to clarify the priorities of a typical worker. The first treated accumulation and decumulation as one long period (Pfau 2011a). He concluded that for workers nearer to retirement (e.g., 10 years), a portfolio consisting of 100% stock allocation provides only slightly higher potential retirement income than a 50% stock allocation. This illustrates the importance that time has on retirement success as a function of compounding interest. Pfau's second article (2011b) showed that in light of market volatility, the focus of a pre-retiree should be on savings—not withdrawal—rates. This is because absent earnings shocks such as job loss or furlough, savings rates required to meet spending goals are less volatile. Pfau (2011b) concluded by positing guidelines to help inform potential sustainable savings rates before retirement. The third paper differentiated the rational versus actual investor in terms of asset allocation. While high stock allocations produce higher mean and median retirement income, it may not be appropriate for risk-averse investors, underscoring the importance of realistic assumptions when comparing different asset allocation portfolios (Pfau 2011c).

Sexauer et al. (2012) sought to establish a benchmark to which actual retirement portfolios could be compared to preserve longevity-risk protection. They used laddered Treasury Inflation-Protected Securities (TIPS) for the first 20 years of retirement with the purchase of a deferred annuity that would begin payouts in year 21. The authors concluded that the benchmark not only addressed the issue of longevity in retirement but solved for inflation and liquidity concerns as well.

Pfau (2012) also utilized benchmarks to model retirement portfolios in terms of asset allocation. Taking time horizons and risk tolerance into consideration, Pfau (2012) sought to establish a framework in handling the interaction between asset allocation and sustainable withdrawal rates (SWR). He found that many sub-optimal allocation-SWR combinations are justifiable because incorporating more bonds in a retirement plan often eases the worker's market volatility concerns, especially in shorter time horizon scenarios.

Scott and Watson (2013) strove to maintain the sustainability of a retirement portfolio while breaking away from the traditional asset allocation model. By investing 85% of assets in an annuity to maintain the minimum desired lifestyle in retirement while placing the remaining 15% into a three-times leveraged exchange-traded fund (ETF), the retiree can capture the upside potential of the stock market. The authors stressed that conducting annual spending reviews is crucial to ensure the portfolio's longevity.

Pfau (2013a) incorporated even more variables into the retirement calculation. He pointed out that retirees typically spend more earlier in retirement (not including healthcare costs). During the early retirement years, retirees are usually in better physical health and can travel more and engage in physically-demanding activities. Also, Pfau (2013a) incorporates the decision of when to draw Social Security benefits into the client's retirement plan. Not only do traditional retirement strategies fail to account for Social Security—most cannot account for alternative fixed income solutions such as annuities.

Pfau dedicated a study the same year (2013b) to the impact of annuity use on retirement outcomes. He tested a guaranteed lifetime withdrawal benefit (GLWB) rider within a variable annuity (VA) product against traditional retirement strategies to meet retirement goals. Pfau (2013b) found the GLWB-VA to be a viable approach while factoring in both administrative fees and inflation.

Sun and Webb (2013) pointed out that households often follow rules of thumb (such as the 4% rule) when deciding how much to decumulate from their portfolios during retirement. The authors offered several strategies such as decumulating an amount equal to required minimum distribution (RMD) tables of the IRS as well as withdrawing RMD principal but only spending interest and dividends to extend the retirement plan's longevity. Sun and Webb (2013) found that these strategies were sub-optimal especially given that consumption is rarely smoothed in actuality during retirement.

Pfau (2017) sought to find the most efficient approach to meet retirement spending needs utilizing both risky portfolios and risk-pooling assets (such as annuities or life insurance) to maintain lifestyle in retirement and leave legacy funds to heirs. Risky portfolios varied across different asset allocations. Pfau (2017) found that, based on historical interest rates, bond ladders alone could not meet both retirement goals. Using a 50/50 allocation, in the worst-case scenario, the retiree ran out of money at age 79. Overall, the retiree's portfolio succeeded (i.e., had a positive account balance at the death of the retiree) 75% of the time with a 50/50 allocation assuming a partial annuitization strategy was used to cover daily living expenses.

2.2. The Impact of Fraud on Retirement Outcomes

There are many causes attributable to a lack of retirement success, defined as the inability for one's retirement income portfolio to adequately maintain one's desired lifestyle until death. One's level of wealth, specifically the income generated over the accumulation stage of life, determines the impact Social Security has upon retirement as well as the replacement ratio needed to fund in retirement. Investment returns also affect one's retirement preparedness. In particular, the closer one is on either side of retirement, the more the investment returns matter (sequence of return risk). Also, following "rules of thumb"—especially in the absence of sound financial planning advice—negatively affects retirement preparedness.

Many risks threaten a retirement plan. Of the more than 15 post-retirement risks, the Society of Society of Actuaries (2011) identified longevity—the chance of outliving one's retirement funds—as number one. Retirement planning, specifically distribution strategies, is more actively researched than any other area within the financial planning literature (Malhotra 2012). Past research has also identified a multitude of other threats to a retiree's nest egg, which exacerbate longevity risk: stock market returns and counterparty actions.

Perhaps the most significant factor that determines retirement success is the rate in which the retiree withdraws from his or her portfolio. Withdrawals both mute positive investment returns and exacerbate negative returns. This is known as sequence of returns risk. Sequence of returns risk is the chance that one's retirement plan assets will be overly affected by portfolio returns (compared to the average) due to the account's value (Basu and Drew 2009). For example, if the stock market had a stellar year and increased in value by 50%, one's retirement plan might be affected within or outside of expectations, and that will usually depend on the participant's proximity to retirement. The closer one moves towards retirement, the larger the account size and the more sensitive the raw account value will be to market volatility. The sequence of returns matters because the risk of a down market jeopardizes a larger amount of both pre-retirement contributions to the account as well as distributions from it in retirement (assuming the worker has saved over time).

In addition to the sequence of returns, falling prey to counterparty risk in the form of egregious fees, bad advice, or even fraud can undermine one's retirement savings program (Society of Actuaries 2011). Counterparty risk is often viewed as intangible and extremely difficult to measure quantitatively. This study places fraud—a type of counterparty risk—on par with other factors that affect retirement preparedness such as savings and withdrawal rates, asset allocation, and annuitization decisions.

No published study has investigated the impact of counterparty risk, namely fraud caused by those in financial services broadly construed, on retirement preparedness. There are some studies (whose data remains unpublished) on the financial consequences of elder financial abuse as well as those published by regulatory authorities and "watchdog" organizations that estimate the aftermath but in aggregate form. However, no study specifically measures, on an individual level, how being a victim of fraud influences retirement outcomes. Researchers should be able to better estimate the effects of fraud and other counterparty risks in their models given the results of this study.

In addition to normalizing the impact of fraud on retirement with other concepts already in the literature, this new knowledge can assist stakeholders in identifying which people are hurt most by fraud. Education and legislation can then be used to target potential victims who fit certain profiles of being defrauded and those who would take advantage of the vulnerable, respectively. Practitioners will be able to incorporate these findings into their practices by discussing fraud with the appropriate clients at crucial times to preempt the wrongdoing.

Much of the retirement planning literature espouses theoretical approaches with each study maintaining fixed assumptions on a worker's situation. Two additional, equally important, considerations when analyzing portfolio success include possible shocks—or events that result in a sudden loss of assets—and uncertainty. Comprehensive retirement planning models should incorporate both fixed shocks (those that deal a set amount of damage to the retirement plan, at a certain time, or both) and uncertainty (usually modeled via Monte Carlo simulations).

2.3. Shocks

A shock is an unexpected change in a person's circumstances—before or during retirement—that threatens the longevity of the retirement funds. The literature divides shocks into two categories: financial and health-related. Examples of financial shocks include the value of assets held, major expenditures that are non-health related, or the loss of a job. This essay adds financial fraud to the list.

French et al. (2007) noted that there can be sudden run-ups (or downs) in the value of retirement assets, specifically those that are frequently traded over a market (but could also include other assets such as real estate). These rapid fluctuations can lead to no loss in overall asset value despite attempts to spend-down retirement assets. Conversely, sharp downturns can mean exhausting retirement funds quicker than expected. French et al. (2007) indicated that elderly retirees tend to hoard more assets than they typically need for fear of run-downs in asset value or unanticipated expenses.

Timmermann (2016) identified job loss, loss of assets due to economic turmoil, major expenditures, or fraud, and the death of a spouse as potential financial shocks that could impede retirement goals. The retiree need not be the cause (or part of the cause) for shocks to occur. This is typically the case because, by their very nature, shocks are unexpected events. Nevertheless, it is important to include fail-safes into one's retirement planning program (Society of Actuaries 2011; Timmermann 2016).

Saad-Lessler et al. (2018) matched data from the Survey of Income and Program Participation to Social Security Administration earnings records to investigate the effect of financial shocks on retirement outcomes during the 2009–2011 years. When a worker experiences an earnings loss of 10% or more, this results, on average, in a loss of $450 in retirement savings in a given year. If the worker was unemployed for one week, he or she lost an effective $55 in retirement savings. Finally, diversification within a corporate retirement plan increased a worker's retirement savings. All of these findings applied only to lower-income workers (those making less than $53,796 in 2009 dollars) and not to higher earners (those making over $106,800 in 2009).

Often, financial and health-related shocks are interrelated. Miller et al. (2018) investigated the effects of family-related financial shocks on a pre-retiree's time horizon. They found that when a child moves out, parental support to that child decreases, on average, by $1500 per year over the next four years. This reduces the likelihood of retiring after age 65 by 9%. A particularly interesting find, other than a respondent's or spouse's health deterioration, most other family events were not significant in the study, including child marriage, child employment (gain or loss), and the improvement of the respondent's or spouse's health.

Health-related shocks are similar to financial ones. The key difference lies in the indirect impact that health-related shocks have on retirement accounts. The unanticipated health event incurs a cost that must be paid. If no other assets are available, the retirement plan must be leveraged or liquidated. Health-related shocks extend to psychological factors, aging, and disability.

Owen and Wu (2007) linked concern over retirement adequacy to psychological factors. In addition to specific changes to a worker's assets, general pessimism is largely to blame for a worker's attitude towards his or her retirement. Nevertheless, experiencing financial shocks during retirement does in fact lead to greater retirement worry.

Concerning changes in assets, Coile and Milligan (2009) highlighted an interesting trend. As a household ages, it decreases ownership of real property, vehicles, business holdings, and financial (marketable) assets. Yet, increased age strongly correlates to increased ownership of liquid assets and time deposits. Coile and Milligan (2009) also identified two factors that strengthen the magnitude of health-related shocks, such as the death of a spouse—time since the event and the presence of physical or mental impairments. McGeary (2009) added that health shocks suffered by an individual or a spouse increase the probability of retirement soon after the shock occurs.

Conley and Thompson (2013) qualified the McGeary (2009) finding. A health shock most often results in retirement only when it is acute (cancer, lung disease, heart attack or disease, and stroke) and when it is suffered by older (50 years and above) men. This effect was stronger for African–American males than those of other races.

Around the same time, Dushi and Rupp (2013) explored the differences between the disabled and non-disabled American populations regarding retirement outcomes. To no surprise, non-disabled persons enjoyed greater financial security even after retirement than their disabled counterparts. Workers who suffered disability shocks experienced higher instances of poverty and lower median incomes. Those who were unable to recover from the disability shock fell behind in most financial respects except obtaining health insurance coverage (Dushi and Rupp 2013).

Blanchett (2018) analyzed the contrast between when Americans expect to retire and when they do. Overall, people tend to retire early, which negatively affects retirement savings. Individuals expecting to retire before age 61 actually retire later while those who anticipate retirement after 61 do so early at a rate of $\frac{1}{2}$ year for each anticipated year post-61.

2.4. Uncertainty

Shocks—both financial and health-related—can have dire consequences on a retiree's savings. Another wrench in the retirement plan surrounds the question of how to account for uncertainty—the possibility that a known risk will occur or the magnitude of that risk's effects. Several articles have been published offering frameworks and measures to account for various aspects of retirement planning uncertainty. Gustafson et al. (2005) determined the percentage of a worker's income that should be saved for retirement. The model included several factors, including varying rates of return, changes in worker salary, time horizon, and the percentage of retirement income that would come from savings (as opposed to pensions, Social Security, inheritance, etc.). The authors developed a web-based model that takes all of these variables into account as input and returns the minimum savings rate needed to maintain a specified standard of living in retirement (Gustafson et al. 2005).

Blanchett and Kaplan (2013) introduced the concept of gamma as another "Greek" statistic that should be accounted for in a sound retirement plan. Unlike alpha or beta, gamma measures the value-add to the efficiency of a retirement portfolio through five factors: account types (tax treatment); asset allocation; annuity allocation; withdrawal rate; and funding risk (a vector comprising several distinct risks such as currency and inflation). Blanchett and Kaplan's (2013) model returned 22.6% more certainty-equivalent income than traditional strategies, which is equal to 1.59% alpha or excess returns.

Fan et al. (2013) presented a different, "adaptive" model as an alternative to traditional retirement planning strategy. They treated retirement spending as a liability and also took into account intertemporal spending and recourse decisions (the ability to rebalance as a result of recent-past market performance). The model that Fan et al. (2013) employed limited underfunded retirement outcomes and increased retirement surpluses.

One way to account for uncertainty is to introduce new measures or frameworks to rationalize a set of assumptions within the retirement calculation. Another way is to run Monte Carlo simulations. These simulate the wide range of possible values for the uncertain variables, saving both time and expense. An industry standard has arisen out of the literature whereby 5000–15,000 simulations are typical with a 90% success rate constituting acceptance of the model (Bengen 1994; Ervin et al. 2009; Blanchett et al. 2012; Malhotra 2012).

Ervin et al. (2009) were one of the first to model the interaction between asset allocation, savings rates, and time horizons using Monte Carlo analysis. They additionally incorporated Social Security, both 80% and 100% replacement ratios, and increased savings rates within the simulations. Their study showed the inadequacy of bond-heavy portfolios in retirement planning—the greater the equity portion of a saver's retirement funds, the higher the chance of a successful retirement in terms of longevity risk.

Blanchett et al. (2012) developed a withdrawal efficiency rate (WER) metric, which identifies the optimal withdrawal strategy under certain conditions assuming the investor has perfect information at the start of retirement. They found spending strategies that adjust for ongoing changes both to rates of return and life expectancy outperform traditional approaches. Blanchett et al. (2012) were able to model both market and mortality uncertainty with Monte Carlo in their WER calculations.

Malhotra (2012) took the uncertainty-based model one step further in producing a model comprising a retirement planning solution outside the traditional stock/bond asset allocation model. Not only did he include fixed-income assets, such as annuities, he also incorporated the effect of the Social Security decision in the model. Malhotra (2012) explored the consequences of retirement portfolio failure by segmenting the fixed income cash flows from the risky portion of the retiree's overall portfolio.

2.5. Fixed Income

Markowitz's (1952) watershed essay introduced Modern Portfolio Theory (MPT) to the finance research landscape around the time of high-profile pension collapses and Friedman's (1957) espousal of the permanent income hypothesis. The primary tenet of MPT is for risk-averse investors to allocate portfolio funds across multiple asset classes, specifically fixed income (bonds, treasury inflation protected securities or TIPS, and annuities). This theory rests on the assumption that investors desire the greatest return for the same level of returns or minimal risk given a level rate of return (Shipway 2009).

Fixed income assets have added value to portfolios in the wake of strong market corrections such as the financial crisis of 2008 (Pittman et al. 2019). These assets help shield the portfolio from the combined effect of normal systematic risk (market volatility) with systemic risk (the subtle relationship between mortgages, shady lending practices, and asset securitization in the form of mortgage-backed securities and credit default swaps).

Another benefit of fixed income is its commonly-lower expense ratios (the amount of money an investment company spends on administrative and operating expenses as a function of total assets) when included in a pooled investment such as a mutual fund. Fixed-income portfolios have historically maintained lower expense ratios compared to their equity counterparts (Houge and Wellman 2007). In fact, this discrepancy has widened over time.

The third benefit of fixed income is that it provides peace of mind to retirees. Assuming adequate flooring (steady income from bond ladders, annuities, etc.), retirees can afford to capture greater returns in the market by higher equity allocations of the non-flooring portions of their portfolios (Zwecher 2010). The amount of necessary flooring usually coincides with the amount of projected nondiscretionary expenses in retirement.

Fixed income has been shown in the literature to reduce other types of risk as well. Aniunas et al. (2015) demonstrated how fixed income, when properly modeled, can reduce credit risk distinctly from market risk. Fixed income, which are normally sensitive to interest rate changes in the market, can also immunize the portfolio against this risk (Ortobelli et al. 2018).

Despite these advantages of fixed income, too much allocation can result in reduced retirement success. In a comprehensive study comparing heavy equity allocation portfolios to heavy bond allocations, Ervin et al. (2009) found that heavier bond allocations ultimately resulted in lower retirement success. This was mostly due to the fact that performance gaps between stock and bond-heavy portfolios widened more with stock market gains than during losing periods. Depending on a host of factors, portfolios with too much fixed income could exacerbate longevity risk. Bonds—specifically the issuers of fixed income instruments—greatly suffer from counterparty risk. Zhang et al. (2018) found that corporations whose employees, broadly construed, engage in fraud incur higher costs in the company's bond issues. The question remains whether portfolios containing fixed income outperform—as a function of portfolio success—equity-laden portfolios in the midst of individual-level fraud.

3. Theoretical Framework

3.1. Trinity Studies

The "Trinity" studies—named after the university at which all three authors, Cooley et al. (1998) taught at the time of publication—began in 1998 with an attempt to empirically test Bengen's (1994) 4% rule by modeling stock market returns via historical simulation. Specifically, the authors analyzed portfolio success rates as a function of safe withdrawal percentages while accounting for asset allocation, distribution periods, and the uncertain market returns over rolling 30-year periods using historical stock market data of the S&P500 from 1926 to 1995. For the bond portion of the asset mixture, historical high-yield corporate bond rates were used. Findings from the first Trinity study reinforced the 4% rule because, given the 90% industry-standard success rate of Monte Carlo, no combination of these four dimensions (asset allocation, withdrawal rate, market return, and distribution period) failed at 4% or lower but did show some instances of failure beginning at 5% (withdrawal rates were set at whole number intervals, initially from 3% to 12%).

Several years later, the same authors updated the original Trinity study by including data through 2009 (Cooley et al. 2011). This time, they sought to ratchet-up the safe withdrawal rates at the cost of lowering the acceptable portfolio success rate from 90% to 75%. They found that a retiree can safely withdraw up to 7% assuming a 50/50 asset allocation, as defined by the lower probability of success. When accounting for inflation, the maximum safe rate fell to 4–5%.

In the interest of returning to Bengen's (1994) original asset mix of intermediate government bonds instead of high-yield corporates, Pfau (2015) updated the Trinity study through 2014. Through Monte Carlo analysis, he affirmed that portfolio success rates depend on withdrawal rates, time horizons, and asset allocation. He also noted that retirement outcomes are particularly sensitive to withdrawal rates given what he would later help popularize, "sequence of returns risk," which was a throwback to the portfolio size effect discussed in Basu and Drew (2009) and ultimately introduced in the literature by Nobel Laureate Robert Shiller (2005).

3.2. Fraud Damages

Cone and Laurence (1994) explored securities fraud, specifically Rule 10b-5 violations, which covers fraudulent transactions related to the sale of securities. The authors noted that damages are often calculated on an aggregate basis in class-action lawsuits. These calculations require ascertaining the value of the security had the fraudulent activity not occurred as well as the dates in which each class member purchased or sold the securities. Because proofs of claim are often not collected until after a settlement is negotiated or a judgment is rendered, computer simulations are used to estimate damages—particularly for actively-traded securities. Cone and Laurence (1994) found that defendants in securities fraud cases often pay 36–74% more in damages than necessary, primarily due to the difficulty surrounding successfully estimating damages.

Bruegger and Dunbar (2009) made similar assertions, namely that class action claims allege misstatements that leads to overvaluation of the security in question. The estimated magnitude of fraud equals the difference between the reported price of the security and its true value (had the misstatement not occurred). Bruegger and Dunbar (2009) raised three problems with ascertaining the true value of a security. First, fraudulent misstatements can mask legitimate price drops. Second, misconduct often occurs over time rather than in a single, isolated moment; Unraveling the entire sequence of misreported prices becomes extremely difficult. Third, apportioning losses among class members is a feat in and of itself and lacks tested methods or expert analysis.

Gamble et al. (2014) used a unique data set to identify the causes of and measure the consequences of fraud victimization in older Americans. They found that decreased cognitive ability is associated with risk of fraud victimization. Additionally, overconfidence in financial knowledge is also positively correlated with victimization. Lastly, the willingness to take financial risks increases after being a victim of fraud. Gamble et al. (2014) showed that fraud damage can be psychological as well as financial and that being a victim can lead to a downward spiral as victims become ever more willing to take financial risks.

3.3. The Health and Retirement Study

To date, the only major public data set within household finance that asks respondents about their experience with fraud is the Health and Retirement Study. The HRS, a longitudinal data set that began in 1992 and comprises health and wealth data from approximately 20,000 Americans aged 50 and over (University of Michigan 2019). The HRS contains not only waves of data but also sections that are publicly available and others that are restricted. Most studies use either the core (regular, public) data and the leave-behind questionnaires (LBQs), which are completed by the respondents without the interviewer present. Like many other large, public data sets, the HRS website also contains scholarly publications that utilized the data. A brief search using the term "fraud" on the website revealed eight articles that referenced or used the HRS data to investigate fraud. Of the eight, five were published just within the past two years.

Lichtenberg et al. (2013) used the 2008 LBQ to investigate predictors of fraud in older Americans. They found a 4.5% prevalence of fraud over the prior five years. Since 2008, the HRS LBQs have included the questions, “Have you ever been a victim of fraud in the past five years” as well as, “If so, in which year?” Lichtenberg et al. (2013) also analyzed the 2002 core data and found that age, education, and depression were significant predictors of fraud victimization. Also, fraud prevalence in the same year was three times higher in respondents with high depression and low social needs fulfillment.

DeLiema (2015) analyzed the HRS core data across the 1998 to 2010 waves in her dissertation. She identified the mean age of fraud victims to be aged 61.7 years with $39,466 median income. Younger age and higher socioeconomic status positively correlated with fraud. For each year after age 50, the odds of fraud victimization increased by 3.6%. DeLiema’s (2015) model utilized multiple time-varying variables such as marital status and income, and these variables’ values were measured at the pre-fraud baseline (the year before the year the fraud allegedly took place).

Lichtenberg et al. (2016) utilized HRS data from the 2010 and 2012 waves. The researchers identified a five-year fraud prevalence of 5% to 6.1%, respectively. They also discovered a 4.3% new-incident fraud prevalence from a four-year look-back period from 2012. Lichtenberg et al. (2016) found several positive correlates of fraud victimization: younger-old; higher education levels; and depression.

Many of the 2018 HRS fraud studies cast doubt on any reliable indicators of fraud victimization. Powell (2018) cited research that came to this conclusion. This is particularly frustrating given that elder fraud is at an all-time high. Powell (2018) stressed that planning early is a good way to implement checks and balances with fiduciary powers within the family and thereby reduce the likelihood of fraud.

DeLiema et al. (2018a) drew on the 2008, 2010, and 2012 waves of the HRS to explore risk factors and financial, psychological, and physical consequences of fraud. They found that younger males who were better educated, depressed, with lower levels of non-housing wealth reported fraud more often than other people. Interestingly, cognitive, psychological, and physical health outcomes were not impacted by being defrauded.

The same authors also published another study in 2018 that narrowed in on the types of fraud experienced by respondents of the 2016 HRS wave (DeLiema et al. 2018b). The vast majority of respondents reported no fraud over the past five years. Only 5% of respondents (n = 1268) reported being a victim of fraud that year. Of those, 5% were investment fraud, 4% were prize or lottery fraud, and 30% were others who used or attempted to use the respondent’s accounts without permission. Despite these, DeLiema et al. (2018b) found no single, reliable predictor of fraud victimization.

In an online newspaper article, Mitchell (2018) cited the two prior studies (DeLiema et al. 2018a, 2018b). She highlighted other findings from those two studies than were previously mentioned. Older Americans generally tend to be victims of fraud because they have accumulated more wealth and tend to be less financially literate. Of the 1,260 respondents from the 2008 to 2016 waves, nearly 8% identified as having invested in a fraudulent scheme. Unlike many other recent studies on fraud, DeLiema et al. (2018a, 2018b) and Mitchell (2018) uncovered twice as many fraud cases because they included specific types of fraud in their analyses.

Tapp (2018) used the LBQs from the 2008, 2010, and 2012 HRS waves to investigate elderly (60+) victims of fraud. Of the full sample (n = 13,342), 5.7% reported having been defrauded in the past five years. Those who had been victims of physical attack, received food stamps, were victims of burglary, regularly used the internet, had difficulty paying bills, and younger were significantly more likely to be victimized.

4. Method and Results

4.1. Data

Each year, Morningstar publishes the *Ibbotson's Stocks, Bonds, Bills, and Inflation* (SBBI; Morningstar 2020) year book data. Since 1926, the SBBI has been the leading source of financial data regarding traditional capital market returns. The Trinity Studies above utilized the SBBI data to run their Monte Carlo analyses. This paper utilizes the data from 1929 through 2019 to bring the Trinity Study up to date. In addition, it uses S&P 500 historical returns to model the equity portion of the hypothetical retiree's portfolio. The fixed income portion of the portfolio is modeled using historical returns from intermediate government bonds.

4.2. Methodology

Using the SBBI data from 1929 to 2019, this study performs three sets of Monte Carlo analysis using Octave (the free version of Matlab): the "normal" results (no fraud); the single-incidence of fraud results; and the serial fraud results. Each set of Monte Carlo analysis consists of 10,000 simulations. These results are divided into five tables:

- Table 1—no fraud;
- Table 2—best case fraud scenario (3% magnitude, Year 15);
- Table 3—Random (3–10% magnitude, Years 1–15);
- Table 4—Worst case (10% magnitude, Year 1); and
- Table 5—Serial fraud (average of averages).

Note that the magnitudes listed above follow from the Trinity Studies previously mentioned in the literature review. Recall the annual withdrawal rate from the retirement account ranges from 3% to 10% of the hypothetical retiree's initial account value on day one of retirement. The fraud shocks have been similarly modeled to trigger an additional withdrawal of the specified magnitude, as a function of the retirement date assets, in the year of the shock.

Each output table contains four dimensions. The first dimension is the asset allocation—a ratio of stocks-to-bonds within the hypothetical portfolio, ranging from 100% stocks/0% bonds, in incremental, zero-sum shifts of 25%, to 0% stocks, 100% bonds. Retirement window constitutes the second dimension and ranges from 15 to 40 years in 5-year increments. The third dimension is the withdrawal rate, the percentage of the portfolio's starting value on day one of retirement that is withdrawn every year of the retirement window, ranging from 3% to 10%. The fourth dimension is the portfolio success rate or the percentage chance there is money leftover at the end of the retirement window when the retiree dies.

Table 1 uses the same methodology as the Trinity Studies from 1998, 2011, and 2015. The sole difference is the years of SBBI data used. Each study uses the cumulative SBBI data available at that time. Thus, this study, written in 2020, uses the data up to and including 2019. Tables 2–4 involve single-incidence fraud shocks on the retirement portfolio as a function of both magnitude (the amount of the shock, measured by percentage of starting retirement wealth just as in the Trinity Studies) and time (the year in which the fraud occurs, from 1 to 15, which is the shortest retirement window in the Trinity Studies). If the time range stretched beyond Year 15, certain retirees would not experience fraud at all since they would pass away in Year 15. Due to the portfolio size effect, where shocks to one's retirement account matter most when there is more money in that account, the best-case fraud scenario occurs in Year 15 and is only 3% of the account's starting value. The worst-case fraud scenario, then, is the opposite: 10% magnitude occurring on Year 1 (when the account value is at its zenith). Table 3, the hallmark table of this study, randomizes the single-incidence fraud case both in terms of magnitude (3% to 10%) and time (Year 1 to Year 15). Finally, Table 5 shows the effects of fraud occurring on an annual basis at varying magnitudes throughout the retirement window. After the Monte Carlo analysis was run modeling serial fraud over 100 times, seven distinct output tables emerged. Table 5 reflects the averages of those seven tables.

4.3. Hypotheses

The hypotheses for this part of the overall study are:

Hypothesis 0 (H_0): *Those who are defrauded are no better or worse off in retirement than those who experience fraud;*

Hypothesis 1 (H_1): *Those who are defrauded will experience lower portfolio success rates than those who suffer no fraud; and*

Hypothesis 2 (H_2): *Those whose portfolios contain some bonds (75/25, 50/50, or 25/75) will experience less retirement success reduction versus those with all-equity allocations (100/0).*

It is expected that fraud will take a major toll on retirement success. Those who answer affirmatively to being defrauded will be less prepared to combat longevity risk or the chance that the retiree will run out of money before death.

5. Results

Table 1 updates the Trinity Study as depicted in Pfau (2015) to include 2019 Ibbotson market data.

Table 1. Portfolio Success Rates Using Historical Data (No Fraud).

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds

No Fraud	3%	4%	5%	6%	7%	8%	9%	10%
100/0								
15 Years	100	100	100	90	80	70	65	53
20 Years	100	100	91	80	69	60	47	39
25 Years	100	99	83	73	64	56	40	27
30 Years	100	94	78	68	57	43	37	20
35 Years	100	92	77	60	53	38	28	15
40 Years	100	89	71	56	40	31	22	9
75/25								
15 Years	100	100	100	98	83	73	59	46
20 Years	100	100	95	79	67	52	44	25
25 Years	100	100	84	70	60	49	29	11
30 Years	100	98	78	60	49	37	12	3
35 Years	100	93	70	57	40	28	7	2
40 Years	100	93	67	47	33	7	2	0
50/50								
15 Years	100	100	100	100	85	73	49	35
20 Years	100	100	99	79	60	40	27	5
25 Years	100	100	86	61	46	23	7	1
30 Years	100	100	71	48	28	9	2	0
35 Years	100	97	60	37	12	8	2	0
40 Years	100	87	47	20	2	0	0	0
25/75								
15 Years	100	100	100	99	78	60	38	19
20 Years	100	100	95	65	45	21	8	1

Table 1. *Cont.*

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
No Fraud	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
25 Years	100	100	67	47	23	9	1	0
30 Years	100	88	46	23	9	3	0	0
35 Years	100	72	25	12	10	2	0	0
40 Years	98	47	13	4	0	0	0	0
0/100								
15 Years	100	100	99	90	65	38	23	13
20 Years	100	95	77	43	25	11	3	0
25 Years	97	80	40	26	9	3	0	0
30 Years	83	46	25	9	3	0	0	0
35 Years	73	30	12	10	2	0	0	0
40 Years	64	15	4	0	0	0	0	0

Success (90%+) is denoted in Green; Failure in Red.

Table 2 shows the best-case scenario in which the retiree is defrauded only 3% of the account's starting value and in Year 15, when retirement funds have been largely exhausted.

Table 2. Portfolio Success Rates Using Historical Data (3% Shock, Year 15).

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Best	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
100/0								
15 Years	100	100	100	86	80	68	64	53
20 Years	100	100	89	79	69	60	47	39
25 Years	100	96	80	71	63	56	40	26
30 Years	100	94	78	66	57	43	35	20
35 Years	100	90	72	60	48	38	28	15
40 Years	100	89	69	55	40	31	20	9
75/25								
15 Years	100	100	100	96	81	71	59	44
20 Years	100	100	93	79	67	51	43	25
25 Years	100	100	83	70	57	49	27	10
30 Years	100	95	77	60	46	35	11	3
35 Years	100	93	70	57	40	25	7	2
40 Years	100	93	65	44	31	7	0	0
50/50								
15 Years	100	100	100	98	84	68	44	34
20 Years	100	100	95	76	57	39	25	5
25 Years	100	100	83	60	44	21	7	1
30 Years	100	97	69	46	25	9	2	0
35 Years	100	92	57	35	12	7	2	0
40 Years	100	85	44	20	2	0	0	0

Table 2. *Cont.*

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Best	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
25/75								
15 Years	100	100	100	98	75	54	34	18
20 Years	100	100	91	64	43	19	7	1
25 Years	100	99	61	39	21	7	1	0
30 Years	100	86	46	23	9	2	0	0
35 Years	100	62	25	12	8	2	0	0
40 Years	93	44	13	2	0	0	0	0
0/100								
15 Years	100	100	98	86	56	35	19	11
20 Years	100	89	71	41	24	9	3	0
25 Years	94	77	39	24	9	3	0	0
30 Years	82	43	23	9	3	0	0	0
35 Years	70	28	12	8	2	0	0	0
40 Years	58	13	2	0	0	0	0	0

Success (90%+) is denoted in Green; Failure in Red.

Table 3 reveals the randomized scenario where each iteration of the Monte Carlo analysis models the fraud in different magnitudes (from 3% to 10%) across the shortest retirement window (Year 1 to Year 15).

Table 3. Portfolio Success Rates Using Historical Data (3% to 10% Shock, Years 1–15).

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Random	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
100/0								
15 Years	100	100	96	85	79	65	61	48
20 Years	100	100	84	75	68	57	45	35
25 Years	100	96	80	70	60	53	39	23
30 Years	100	89	77	63	55	42	34	18
35 Years	100	88	72	58	45	37	25	12
40 Years	100	87	65	55	38	31	16	5
75/25								
15 Years	100	100	100	91	79	68	58	43
20 Years	100	100	91	77	64	51	37	21
25 Years	100	100	81	67	56	40	21	9
30 Years	100	94	75	60	45	32	11	3
35 Years	100	92	68	50	38	15	7	0
40 Years	100	91	58	42	25	7	0	0

Table 3. *Cont.*

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Random	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
50/50								
15 Years	100	100	100	98	81	64	43	34
20 Years	100	100	92	73	55	37	20	5
25 Years	100	100	79	59	43	19	6	1
30 Years	100	94	65	43	23	9	2	0
35 Years	100	87	53	32	10	5	2	0
40 Years	100	80	42	16	2	0	0	0
25/75								
15 Years	100	100	100	95	73	49	29	13
20 Years	100	100	85	64	39	17	7	1
25 Years	100	94	57	34	19	7	1	0
30 Years	100	80	40	22	9	2	0	0
35 Years	100	55	20	12	7	2	0	0
40 Years	93	42	11	2	0	0	0	0
0/100								
15 Years	100	100	95	84	50	33	16	5
20 Years	100	89	65	40	23	7	1	0
25 Years	94	71	37	20	7	1	0	0
30 Years	82	38	22	9	3	0	0	0
35 Years	68	27	12	7	2	0	0	0
40 Years	55	9	2	0	0	0	0	0

Success (90%+) is denoted in Green; Failure in Red.

Table 4 depicts the worst-case single-fraud case that occurs at 10% magnitude on Year 1 of retirement.

Table 4. Portfolio Success Rates Using Historical Data (10% Shock, Year 1).

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Worst	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
100/0								
15 Years	100	100	95	84	71	65	53	40
20 Years	100	99	83	72	63	47	39	24
25 Years	100	90	79	67	57	40	27	17
30 Years	100	89	72	62	48	38	20	6
35 Years	100	85	65	55	43	33	15	5
40 Years	100	78	60	49	33	24	9	2
75/25								
15 Years	100	100	100	89	74	60	46	35
20 Years	100	100	85	72	57	45	25	12

Table 4. *Cont.*

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Worst	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
25 Years	100	96	79	63	49	33	11	3
30 Years	100	92	71	52	38	14	3	0
35 Years	100	85	62	45	30	10	2	0
40 Years	100	80	55	36	15	2	0	0
50/50								
15 Years	100	100	100	93	74	54	35	19
20 Years	100	100	88	69	48	28	5	1
25 Years	100	99	73	50	29	7	1	0
30 Years	100	88	58	38	11	2	0	0
35 Years	100	82	45	18	10	2	0	0
40 Years	100	65	31	4	0	0	0	0
25/75								
15 Years	100	100	100	86	69	39	19	4
20 Years	100	100	77	52	25	9	1	0
25 Years	100	91	51	26	9	1	0	0
30 Years	100	65	29	15	6	0	0	0
35 Years	98	47	18	10	2	0	0	0
40 Years	89	24	5	2	0	0	0	0
0/100								
15 Years	100	100	90	73	40	24	13	1
20 Years	100	87	52	35	13	3	0	0
25 Years	89	59	33	11	3	0	0	0
30 Years	77	35	17	6	2	0	0	0
35 Years	62	22	10	3	0	0	0	0
40 Years	40	5	2	0	0	0	0	0

Success (90%+) is denoted in Green; Failure in Red.

Finally, Table 5 shows the effects of systematic fraud—occurring every year within the retirement account. Like Table 3, the magnitude of each year's fraud is randomized between 3% and 10%.

Table 5. Portfolio Success Rates Using Historical Data (3% to 10% Shock, Every Year).

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Serial	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
100/0								
15 Years	58	49	39	30	22	15	9	5
20 Years	45	35	27	19	12	7	4	2
25 Years	38	28	20	12	7	3	1	0
30 Years	31	23	15	9	4	2	1	0
35 Years	27	19	11	6	3	1	0	0
40 Years	21	14	8	4	1	0	0	0

Table 5. *Cont.*

Inflation-adjusted distributions for various asset allocations, retirement windows, and withdrawal rates using Ibbotson's *Stocks, Bonds, Bills, and Inflation* data (1926–2019), S&P500, and intermediate-term government bonds								
Serial	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
75/25								
15 Years	55	43	33	24	15	9	4	1
20 Years	37	28	18	11	5	2	0	0
25 Years	30	20	11	5	2	0	0	0
30 Years	22	13	6	2	0	0	0	0
35 Years	18	9	4	1	0	0	0	0
40 Years	11	5	1	0	0	0	0	0
50/50								
15 Years	49	35	24	14	7	3	0	0
20 Years	28	18	9	4	1	0	0	0
25 Years	18	9	4	1	0	0	0	0
30 Years	11	5	1	0	0	0	0	0
35 Years	7	3	1	0	0	0	0	0
40 Years	2	0	0	0	0	0	0	0
25/75								
15 Years	40	27	16	8	3	1	0	0
20 Years	18	9	3	1	0	0	0	0
25 Years	10	4	1	0	0	0	0	0
30 Years	4	1	0	0	0	0	0	0
35 Years	3	1	0	0	0	0	0	0
40 Years	0	0	0	0	0	0	0	0
0/100								
15 Years	30	18	10	5	2	0	0	0
20 Years	10	5	2	0	0	0	0	0
25 Years	5	1	0	0	0	0	0	0
30 Years	1	0	0	0	0	0	0	0
35 Years	1	0	0	0	0	0	0	0
40 Years	0	0	0	0	0	0	0	0

Success (90%+) is denoted in Green; Failure in Red.

The foregoing results give rise to a number of general observations. First, the results support findings from earlier studies as to the veracity of the portfolio size effect: The larger the account value, the more devastating the shock. Second, bond-heavy (but not exclusively bond) portfolios tend to dampen the effects of fraud, all else being equal. Third, fraud almost forces conservatism within the retirement portfolio in terms of annual spending especially during longer retirement windows. The tables are listed in overall descending order of portfolio success; by the time the worst case scenario is reached (Table 4), no combination involving a 7% or higher withdrawal rate is successful, and only one combination (75/25, 15 Years) is successful at the 6% mark.

This study set out to determine the overall effects of a single fraud shock on a retiree's portfolio. Table 6 depicts the average change, in percentage points, between the normal

Monte Carlo results (no fraud) and the randomized magnitude and time horizon results from Table 3.

Table 6. Percentage point differences between no fraud and random fraud.

Asset Allocation	Difference
100/0	2.85
75/25	3.13
50/50	2.81
25/75	2.98
0/100	2.52

When averaged, the total average diminished success rate to a retiree's portfolio is 2.86%. Thus, without knowing the exact magnitude or timing of the fraud shock, using Monte Carlo analysis to model stock and bond market uncertainty, the average retiree's portfolio success diminishes by an average of three percentage points when a single fraud incident occurs at some point during the retirement window.

Returning to the question of whether fixed income dampens the effect of fraud shocks on retirement, it is more helpful to include the best and worst fraud shock models as well.

Every case forms a bell curve centered on the 75/25 bond allocation, indicating the peak performance as a function of total number of successful cases. When there is no fraud, the 100/0 and 50/50 allocations provide identical performance (without taking the magnitude of successes and failures into account). In the case of fraud shocks, however, the 50/50 allocation outperforms the all-equity group across the board. Perhaps the most interesting find is the most realistic model (i.e., the random fraud) yields superior performance of the 25/75 allocation over 100/0. Table 7 contains the odds of the investor enjoying a successful retirement over an unsuccessful one. Another way to express this relationship is in terms of probabilities, which have been calculated and presented in Table 8.

Table 7. Retirement success rates by asset allocation—no fraud, best, random, and worst.

Asset Allocation	Successful Portfolio Ratio *			
	No Fraud	Best	Random	Worst
100/0	14:34	12: 36	10:38	10:38
75/25	15:33	15:33	15:33	11:37
50/50	14:34	14:34	13:35	11:37
25/75	12:36	12:36	11:37	9:39
0/100	7:41	5:43	5:43	4:44

Notes: * The total number of successful (green) portfolios within the asset allocation over the total number of unsuccessful (red) portfolios within the same allocation.

Table 8. Retirement success rates by asset allocation—no fraud, best, random, and worst.

Asset Allocation	Successful Portfolio Rate *			
	No Fraud	Best	Random	Worst
100/0	0.29	0.25	0.21	0.21
75/25	0.31	0.31	0.31	0.23
50/50	0.29	0.29	0.27	0.23
25/75	0.25	0.25	0.23	0.19
0/100	0.15	0.10	0.10	0.08

Notes: * The total number of successful (green) portfolios within the asset allocation divided by the total number of portfolios (48). Values are rounded to two significant digits.

While these numbers seem low, remember that these values include the other variables in the Trinity framework: withdrawal rate and time horizon. Regardless of fraud or asset allocation, most portfolios exceeding 4% or lasting longer than 15 years results in failure. Nevertheless, both in terms of magnitude (Table 6), success-to-failure ratios (Table 7), or success rates (Table 8), moderately-weighted bond allocations (75/25, 50/50, and 25/75) often rival or outperform 100/0 portfolios.

6. Conclusions

Both alternative hypotheses—H_1 and H_2—were supported by the results. These findings contribute to the ongoing discussion surrounding the safe maximum withdrawal rate ("Safe Max") that pervades the retirement planning literature. Kitces (2015) analyzed both the 2000 and 2008 stock market crashes. He reported that retirees who followed the 4% rule of Bengen (1994) all through retirement were no worse off, in terms of portfolio success rates, having suffered through the 2008 dot-com bubble burst, the 2008 global meltdown, or both. The present study's findings also call into question the 7% rule (which admittedly did not adjust for inflation) of Cooley et al. (2011) in the first updated Trinity Study; even with a lower acceptability rate of 75% (down from 90%), few portfolios succeed at a 7% withdrawal rate when fraud is involved.

Nevertheless, this study quantifies the damage that fraud wreaks on an individual's retirement plan. Many government agencies and other organizations proffer estimates of damages due to fraud. The Federal Trade Federal Trade Commission (2020) cited $1.9 billion in consumer losses due to fraud in 2019. Admittedly, those losses are self-reported from disgruntled consumers. The United States Sentencing United States Sentencing Commission (2015) referenced a median loss from securities fraud victims of $3,454,756. These results tend to skew to the right largely due to the fact that wealthier investors both have more to lose and thus can deploy more capital to recover the stolen sums. While the present study's findings are based on various assumptions discussed below, they offer concrete estimates of fraud shock damages on retirement portfolio success rates and point to the buffering effect that fixed income has on fraud.

6.1. Limitations

Despite its contribution to the retirement planning literature, the present study suffers from notable limitations, most notably those arising from the built-in parameters of the Trinity Study. Not everyone who suffers from fraud in retirement began withdrawing from their portfolios at age 65 or started with $1,000,000 saved. Also, taxes and other exogenous effects may alter the degree to which fraud impacts portfolio success rates—such as advisor compensation or multiple layers of fees.

Both the magnitude and timing of the fraud shock in this study are arbitrary, taken from the Trinity Studies and are not data-driven in any way. Future research should expand current efforts by the Health and Retirement Study (HRS) and other longitudinal surveys that ask about respondents' financial situation. Currently, the HRS only considers Americans aged 50 or over. Furthermore, the fraud-based questions are not asked during the main interview but are contained in the leave-behind questionnaires (LBQs) of which respondents have the option to complete but are in no way obligated to do so.

Lastly, this study ignores extra safeguards that have been put into place at the federal level such as custodians of retirement accounts and other protections found in the Employee Retirement Income Security Act (ERISA). Recent legislation (such as the SAFE Act) have been passed to curb incidence of fraud with the intention to protect elders, one of this country's most vulnerable populations.

One might think that these limitations undermine the credibility of the present study. However, even if the amount of fraud shock and the age at which the shock occurred were completely fabricated, this study would still contribute the effects of a one-time shock to a retiree's portfolio, which has never been modeled before in the literature. Further value is derived by the new avenues of future research opened from this paper's methodology and results.

6.2. Policy Implications

The present study quantifies the effect of fraud on retirement planning outcomes.

This has implications for financial planning practitioners regarding financial literacy. Lusardi and Mitchell (2014) affirmed that low levels of financial literacy are widespread throughout the United States. The benefits to financial literacy include more prudent saving habits, better debt management, and greater retirement planning outcomes. Lusardi and Mitchell (2014) concluded that increased financial literacy resulted in better financial decision making.

What happens when fraud interacts with financial literacy in terms of retirement planning? Low levels of financial literacy lead to fraud victimization (DeLiema et al. 2018a; Mitchell 2018), and victimization leads one to engage in riskier behavior in the future (Gamble et al. 2014). The present paper shows that fraud leads to poorer retirement outcomes. Theoretically, then, low levels of financial literacy should result in lower retirement success. Yet, there may be more to the story than a simple calculus. Lower levels of financial literacy result, at least in part, from increased cognitive decline (Finke et al. 2017)

Soliciting the aid of a financial planning expert also increases retirement planning outcomes. Martin and Finke (2014) gauged the impact of consulting a financial planner and estimating retirement income needs on savings behavior. They constructed a four-by-four matrix to demonstrate the interactions of these two variables (financial planner and retirement needs calculation). Respondents who utilized the assistance of a financial planner and calculated their retirement income needs had the highest retirement savings of all four groups. The Martin and Finke (2014) study demonstrates that together, knowledge and planning is key to a successful retirement. In terms of financial literacy, it is reasonable to proxy a financial planner's expert knowledge for one's own lacking financial literacy (assuming one has the literacy to hire an advisor).

Knowing the financial impact of fraud on retirement income planning will benefit many interested parties. It could help deter individuals from being defrauded by quantifying the potential damage swindlers may wreak on the retirement funds. Financial planning practitioners and other professionals can better plan by considering the calculable consequences of their clients falling victim to fraud. Lastly, these findings can benefit regulators in crafting rules and penalties to combat fraud incidence within financial services.

Finally, the buffering effect of fixed income on fraud shocks within retirement portfolios should cause scholars, policymakers, and practitioners to revisit the asset allocation discussion within their respective circles. While fixed income introduces several new risks within the retirement conversation, one should question whether these risks outweigh the dampening effect of fixed income on counterparty risk. This opens the door for a plethora of new research possibilities.

6.3. Future Research

There are a multitude of avenues for future research given the findings of the current study. One such channel is investigating the interaction between financial literacy and fraud to discern whether lower levels of financial literacy result in worse retirement outcomes between groups who have and have not been victims of fraud. Another avenue for research would be to question the veracity of respondent fraud claims. Conducting an experiment to mirror account statements whereby members of the control group experienced no fraud and participants in the treatment group did could be used to test not only who is able to correctly identify fraud but also how long (in terms of monthly or quarterly account statements) before the fraud was discovered. Lastly, future research should conduct withdrawal rate and time horizon-level analysis on the interaction between fixed income-heavy portfolio allocations and fraud to determine whether magnitudes, successful-unsuccessful ratios, or success rates depend on how much is withdrawn annually from the portfolio and for how long.

The effect of fraud on a retiree's portfolio is considerable. This has been the first attempt within the retirement planning literature to quantify the effect that fraud has on an individual's retirement plan. This is only the beginning for breaking new ground in measuring fraud damages on an individual's retirement. It may be the case that, once the fraud puzzle is solved with regards to decumulation, scholars can then work backwards and estimate the precise impact that being defrauded early during accumulation has on one's retirement. Until then, planning for retirement early, engaging a financial planner, and increasing one's own financial literacy is the best hope. Armed with these weapons, maybe even the most rational of agents can retire safely in this irrational world.

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Data Availability Statement: The data used to produce the Monte Carlo analysis results is not public but is available for purchase by the general public. The full 2019 SBBI Yearbook data can be purchased here: https://www.duffandphelps.com/insights/publications/cost-of-capital/2019-sbbi-yearbook. Any CFA charter holder may download the latest summary version of the data here: https://www.cfainstitute.org/en/research/foundation/sbbi.

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