How Deep Is The Hole?
Recovering From The Market Downturn of 2008

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Abstract

In this paper we analyze the impact of the market downturn in 2008 on investors nearing retirement. We first assess how declines in typical portfolio values impacted overall projected retirement incomes, factoring in Social Security, future growth and future savings. We then find that even for investors within five years of retirement, modest increases in savings combined with slightly delayed retirement can recover their pre-2008 retirement outlooks if they stay in diversified age-appropriate portfolios. Of these two recovery options, delaying retirement proves to be the most effective. Investors who moved to all-cash portfolios, on the other hand, have more work to do to get back on track. Our analysis finds that these investors are likely to have to delay retirement as much as four years *above and beyond* the steps needed to recover from the 2008 downturn had they stayed in diversified age-appropriate portfolios.

Introduction

In 2008 investors experienced one of the worst bear markets ever. The S&P 500, a common measure of equity performance, was down 38 percent for the year. Exacerbating this problem is the long-term trend of employers shifting from offering defined benefit plans in favor of defined contribution plans.[1] In defined benefit plans, a decrease in the value of the underlying investments is borne by the employer, who must make additional contributions to ensure the guaranteed benefits can be paid. In a defined contribution plan, decreases in value are borne by the individual workers, who must either save more or accept reduced future payouts.

Thus, the market events of 2008 were of great concern to many American workers. They have become increasingly responsible for managing their own retirement accounts, while at the same time they have seen their retirement savings dramatically decrease. As a result, many workers may have feared they would never be able to retire, especially those who were close to their planned retirement age. While the losses experienced in 2008 were indeed dramatic, the consequences for the retirement plans of an average worker are far less severe than commonly depicted.

One reason for the overreaction of many workers may be the highly visible nature of 401(k) plans, which are the most common type of defined contribution plan. By focusing solely on the dollar value of their 401(k) accounts, workers are ignoring the quasi-defined benefit provided by Social Security. This can comprise a significant portion of expected retirement income, especially in the case of lower-income workers.[2] A worker who sees his 401(k) account balance decrease by 30 percent, for example, may incorrectly assume that his retirement income will decrease by a similar amount, or that he must extend his years of work by 30 percent. As we will illustrate in the analysis section, both of these interpretations significantly overstate the severity of the problem.

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[1] In 1985, 80% of full-time employees in medium and large establishments participated in defined benefit plans. By 2000, this had decreased to 36%. Similar figures for defined contribution plans are 41% and 50%, respectively. Source: Bureau of Labor Statistics (www.bls.gov).

[2] Social Security payments increase at a slower rate than income. In percentage terms, lower-income workers will have more of their retirement income provided by Social Security than higher-income workers. Further details are provided in the analysis section.

We begin our analysis by creating a set of sample workers representative of older workers, and assigning them 401(k) portfolios as of the start of 2008 that are projected to provide them with adequate retirement income.[3] We then adjust the portfolios for actual returns experienced during 2008 and re-evaluate their "retirement readiness" as of the end of 2008.

The second part of our analysis involves evaluating alternate strategies for recovering from the losses incurred during 2008. Specifically, we evaluate the effectiveness of increasing savings rates versus delaying retirement.

The third part of our analysis focuses on the impact of panicking and switching to an all-cash portfolio at the end of 2008.

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[3] We calculate the required portfolio balance for the sample workers based on the assumptions of ongoing contributions, asset growth and the receipt of future Social Security payments. Full details are provided in Analysis—Part 1.

Analysis

Part 1—How Deep Is the Hole?

We base our analysis on nine sample workers intended to represent a cross-section of the older American workforce. These are created by combining three possible ages (50, 55 and 60) with three possible salaries ($50,000, $75,000 and $100,000). For each of these workers, we construct a portfolio designed to provide a 50 percent probability of replacing 70 percent of preretirement income, when combined with forecast Social Security payments.[4] For example, for a worker earning $50,000 per year, his portfolio would have to provide a 50 percent probability of providing at least $35,000 per year in retirement (when combined with forecast Social Security payments). We calculate both the required total portfolio balance and a diversified age-appropriate asset allocation within the portfolio for each of the nine workers at the start of 2008. These portfolios are based on the assumptions that the workers will be making ongoing contributions until retirement and will receive full Social Security payments when in retirement.[5] A summary of these pre-drop portfolios are shown in Tables 1 and 2.

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[4] The portfolios are constructed using Financial Engines' optimization and simulation software, assuming the person has access to the full range of mutual funds offered by The Vanguard Group, Inc. The Vanguard Group, Inc. was selected for this analysis due to its broad representation of mutual funds including both low-cost index funds and actively managed mutual funds. Further details of Financial Engines' optimization and simulation software can be found in Appendix II—Methodology.

[5] Ongoing contributions are 9%, which represents an employee contribution of 6% of salary combined with an employer contribution of 3% of salary (a typical matching scheme). All sample workers are assumed to retire at age 65, at which time they will begin receiving Social Security payments. These payments are adjusted to account for differences in full retirement ages based on the years of birth.

TABLE 1

Pre-Drop Portfolio Allocations (Start of 2008)[6]

AGE	EQUITY %	FIXED INCOME %
50	82%	18%
55	74%	26%
60	64%	36%

TABLE 2

Pre-Drop Portfolio Values (Start of 2008) [7]

	SALARY		
AGE	$50k	$75k	$100k
50	$ 75,600	$ 161,600	$ 252,500
55	$ 120,200	$ 241,000	$ 367,800
60	$ 151,200	$ 312,600	$ 503,200

Each sample worker's portfolio is then updated through 2008. At the end of each quarter, new contributions are added and the portfolios are rebalanced to a new diversified age-appropriate asset allocation as of that date. Table 3 shows the percentage change in portfolio values from the beginning of 2008 (pre-drop) to the end of 2008 (post-drop).

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[6] All portfolios are constructed using a line-up of 42 Vanguard mutual funds. Of these, 34 are Equity funds and eight are Fixed Income funds. Equity funds include both domestic and international equity funds, and Fixed Income funds include money market funds and short-term, medium-term and long-term bond funds.

[7] All portfolio balances and income values are rounded to the nearest $100.

TABLE 3

Change in Portfolio Values in 2008
(Post-Drop Portfolio Values Below)

		SALARY	
	$50k	$75k	$100k
50	-28% $ 54,200	-29% $ 114,200	-30% $ 177,600
55	-27% $ 87,800	-28% $ 174,600	-28% $ 265,700
60	-23% $ 116,100	-24% $ 238,300	-24% $ 382,600

AGE (vertical label for rows)

While all portfolios suffered significant decreases in value, the largest drops occurred for the youngest and highest income workers. Younger workers suffered more as they had larger equity allocations, and higher income workers suffered more as they receive a smaller percentage of their retirement income in the form of "fixed" Social Security payments and consequently must have larger portfolios relative to their salaries.

Next, we re-evaluate each sample worker's post-drop portfolio to determine their revised probability of reaching their retirement income goal. Results are shown in Table 4.[8]

TABLE 4

Post-Drop Probability of Reaching Retirement Income Goals (End of 2008)

		SALARY	
	$50k	$75k	$100k
50	12%	10%	9%
55	5%	5%	5%
60	< 5%	< 5%	< 5%

AGE (vertical label for rows)

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[8] Note that the sample workers will have aged one year during 2008. For example, an age 50 worker will be age 51 at the end of 2008. This aging is taken into account in our calculations throughout this paper, but we use the pre-drop (start of 2008) ages as headings in all Figures and Tables to avoid confusion.

Recall that at the start of 2008 all of the portfolios were constructed to provide a 50 percent probability of reaching the respective retirement income goals. The new probabilities are significantly lower, ranging from 12 percent to less than 5 percent.[9]

On the surface, having no more than a 12 percent probability of reaching a retirement income goal sounds very dire. However, it is important to keep in mind that a low chance of reaching a retirement income goal does not mean that the median sample worker will receive *no* income at all. To illustrate this, we recompute the median forecast retirement incomes for the sample workers. The original (pre-drop) retirement income forecasts are shown in Table 5, and the percentage change between the pre-drop and post-drop retirement income forecasts are shown in Table 6.

TABLE 5

Pre-Drop Median Forecast Retirement Income (Start of 2008)

		SALARY		
		$50k	$75k	$100k
AGE	50	$ 35,000	$ 52,500	$ 70,000
	55	$ 35,000	$ 52,500	$ 70,000
	60	$ 35,000	$ 52,500	$ 70,000

TABLE 6

Change in Median Forecast Retirement Income in 2008

(Post-Drop Median Forecast Retirement Income Below)

		SALARY		
		$50k	$75k	$100k
AGE	50	-11% $ 31,000	-16% $ 44,100	-18% $ 57,100
	55	-12% $ 30,700	-16% $ 43,900	-19% $ 56,900
	60	-10% $ 31,400	-14% $ 45,100	-17% $ 58,100

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[9] We consider all probabilities below 5% to be sufficiently small as to not require further breakdown.

In summary, the sample workers suffer portfolio losses ranging from 23 percent to 30 percent as a result of the market downturn of 2008. The impact on their median forecast retirement incomes is partially mitigated by the fixed nature of Social Security payments, with the resulting decreases ranging from 10 percent to 19 percent. The highest income workers suffer the largest portfolio losses and median forecast retirement income losses.

Part 2—How To Climb Out of the Hole?

In Part 1, we illustrated the impact of the 2008 market drop on a set of sample workers' portfolios and the resulting decreases in their median forecast retirement incomes. In this section, we evaluate the effectiveness of two key strategies the sample workers can employ to return to their pre-drop level of forecast retirement income:

1. Save more

2. Work longer

Before discussing these strategies, it is worthwhile to mention two other options that are frequently proposed. The first is to simply spend less in retirement. While this would indeed solve the problem, it is a trivial solution that can be applied to virtually any financial setback. Our analysis is based on the premise that the sample workers want to return to their pre-drop level of forecast retirement spending, and are neither willing nor able to accept a lower income level.

The second omitted option is for sample workers to increase the risk of their investments in the hopes of getting larger returns. Taken to the extreme, a sample worker with this philosophy would take his remaining funds and purchase lottery tickets, hoping for a big win. While there is an extremely small probability of great success with this strategy, the median outcome is disastrous (i.e., $0), and no prudent financial advisor would recommend this course of action. In our analysis, sample workers remain invested in diversified age-appropriate portfolios—they do not "solve" their problems by taking inappropriate risks.

Option 1—Save More

In constructing the sample workers' portfolios, we assume they will be making ongoing contributions until retirement equal to 6 percent of their salary, supplemented by a company match of 3 percent of their salary. In this section, we analyze how much the sample workers will have to increase their savings rates to compensate for the market drop of 2008. In our analysis, we assume there are no additional employer contributions (i.e., the matching scheme is 50 percent of employee contributions to a maximum employer contribution of 3 percent of salary).

Using the post-drop portfolio values calculated in Part 1 as a starting point, we calculate the break-even savings rate required in order for each of the sample workers to return to a 50 percent probability of replacing 70 percent of their preretirement income at the planned retirement age of 65. These values are shown in Table 7.

TABLE 7

Post-Drop Break-Even Savings Rates (End of 2008) [10]

	SALARY		
	$50k	$75k	$100k
50	16%	19%	20%
55	22%	26%	28%
60	36%	45%	52%

(AGE labels the rows 50, 55, 60)

Recall that we calculated the pre-drop portfolio balances based on the assumption that the sample workers would be contributing at a combined rate of 9 percent. Thus, the break-even savings rates shown above represent increases ranging from 1.8 to 5.8 times the original 9 percent rate. Younger, lower-income workers have the lowest required increases, while older, higher-income workers have the highest required increases.

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[10] The figures represent the total savings rate required. For example, 16% = current employee contribution of 6% + current employer contribution of 3% + increase in employee contribution of 7%.

The young versus old difference is explainable when one considers the contributors to 401(k) wealth at retirement:

1.   Current assets

2.   Growth of current assets between now and retirement

3.   Future contributions

4.   Growth of future contributions between the time they are made and retirement

Older workers have larger amounts of current assets (which were impacted by the downturn) and smaller amounts of future contributions (which were not impacted by the downturn). Conversely, younger workers have smaller amounts of current assets and larger amounts of future contributions, and as a result were hurt less by the market downturn.

The low salary versus high salary difference is due to the nature of Social Security payments. Although Social Security payments increase with salary, they do so at a decreasing rate. Thus, higher-income workers will have a smaller percentage of their preretirement income replaced by Social Security payments, even though they are receiving a larger absolute dollar amount. This means higher-income workers have to fund a larger percentage of their retirement income from their own savings, which requires a larger portfolio relative to their salary. Consequently, they were hurt more by the market downturn.

All of the savings rates in Table 7 are less than 100 percent, so it is theoretically possible for all of the sample workers to save themselves back to retirement security. Whether this is practical depends on two other factors. First, is the savings rate realistic given their individual situations? In the best case (age 50 – salary $50,000), the savings rate would have to increase from 9 percent to 16 percent, or from $4,500 to $8,000. This is similar to incurring a $3,500 gross pay cut, which is something that many workers making $50,000 would find difficult to accommodate.

Second, there are IRS limits on the dollar amount of employee contributions to a 401(k) plan. Currently these are $16,500 plus an additional $5,500 for workers age 50 or older. We combine this with the 3 percent employer contribution to calculate the maximum allowable contributions for the sample workers. Results are shown in Table 8.

TABLE 8

Maximum Allowable 401(k) Contributions

	SALARY		
	$50k	$75k	$100k
$ Amount	$ 23,500	$ 24,250	$ 25,000
% of Salary	47%	32%	25%

Comparing the maximum contributions (Table 8) to the required break-even values (Table 7), we see that three of the required savings rates are in excess of IRS limits. These are highlighted in Table 9.

TABLE 9

Post-Drop Break-Even Savings Rates (End of 2008)

(Invalid Rates in Red)

		SALARY		
		$50k	$75k	$100k
	50	16%	19%	20%
AGE	55	22%	26%	28%
	60	36%	45%	52%

Thus, for the three sample workers in the bottom right of the table,[11] they simply cannot increase tax-deferred savings enough to recover. An alternative would be to save as much as possible in a tax-deferred vehicle and the remainder in a taxable vehicle. Unfortunately, this would require increasing the overall savings amount to compensate for the partial loss of tax deferment. Given that the savings rates are already beyond the realm of practicality for most workers (28 percent to 52 percent of salary), we did not further investigate this option.

In summary, to overcome the market downturn of 2008, the sample workers will have to save from 16 percent to 52 percent of their gross income,[12] with the savings rate increasing with both salary and age. We conclude that while increasing savings by itself may be a viable solution

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[11] Age 55 – Salary $100,000, Age 60 – Salary $75,000 and Age 60 – Salary $100,000.
[12] These figures include the 3% employer matching contributions.

for younger, lower-income workers, it rapidly becomes infeasible for older and/or higher-income workers.

Option 2—Work Longer

In the prior section we discover that for many workers, simply saving more is not a viable way to recover from the market drop of 2008. Thus, working longer will have to be part of their recovery plans. In this section, we evaluate the impact of working longer (i.e., delaying retirement). As before, we use the nine sample workers in the analysis, and assume that they can continue working in their current jobs for up to four additional years (i.e., up to age 69).

We start with an analysis for the sample worker aged 60 who is earning $50,000 per year. In Figure 1, we show the total savings rate required if this worker were to delay retirement by one to four years (i.e., retire at ages 66 to 69). For comparison, we also include the savings rates for retirement at age 65, as calculated in the prior section.

FIGURE 1

Post-Drop Break-Even Retirement Savings Rates

**($50,000 Salary, Age 60 Sample Worker)**

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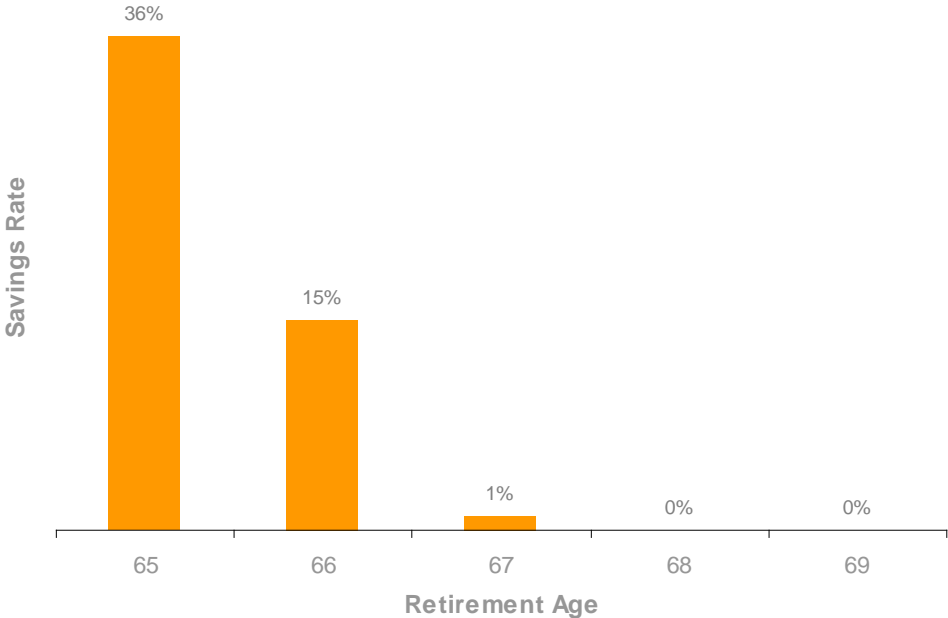
The effect of delaying retirement is dramatic. The sample worker aged 60 can reduce his savings rate from 36 percent to 15 percent (a 21 percent reduction) by delaying retirement one year. Were this sample worker to delay retirement two years, he could reduce his savings rate to 1 percent (which is 8 percent *below* his current savings rate). While one or two additional years of work is not trivial, it does have an amazing impact on the sample workers' ability to recover from the market downturn.

There are four key reasons why delaying retirement is so powerful:

1. Increased savings—Simply put, more money is being saved.

2. Increased growth—Both existing and new savings have more time to grow.

3. Increased Social Security payments—We are assuming that the sample worker will delay receipt of his first Social Security payment until the year he retires. This will result in higher payments over the remaining retirement years.

4. Fewer years of retirement to fund—Each additional year of work results in one less year of retirement that must be funded.

Next, we calculate similar break-even savings rates for the other two sample workers earning $50,000 per year (i.e., those aged 50 and 55). The results are shown in Figure 2, along with a repeat of the results for the sample worker aged 60.

FIGURE 2

$50,000 Salary Post-Drop Break-Even Retirement Savings Rates
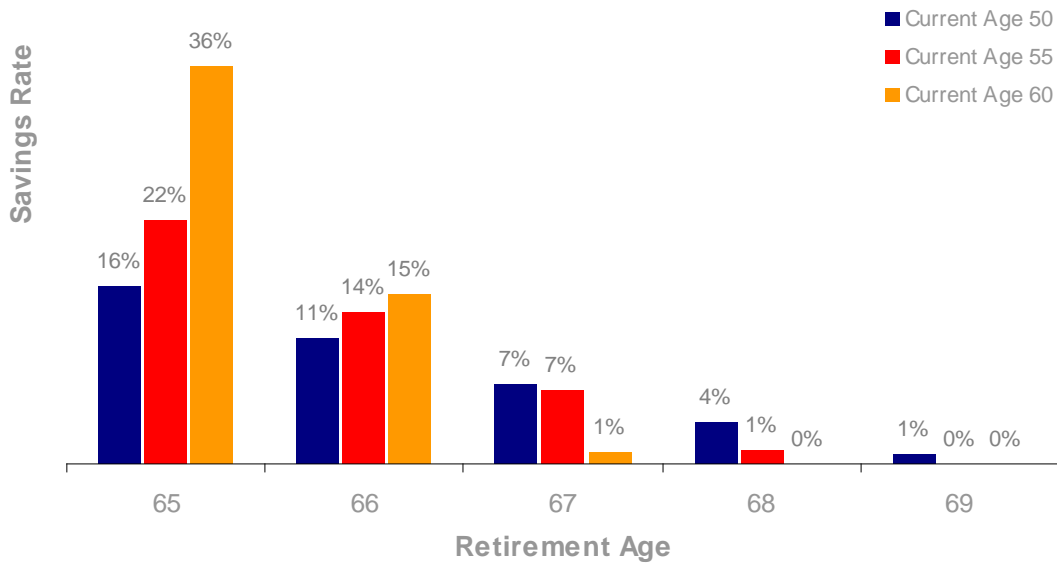

As can be seen, workers of all ages benefit from delaying retirement, with the greatest benefit being realized by the oldest workers. Intuitively, this makes sense as one additional year of work for an age 60 worker represents a greater percentage increase in remaining working years than for an age 50 worker.

Results for the sample workers earning $75,000 per year and $100,000 per year are shown in Figures 3 and 4, respectively.
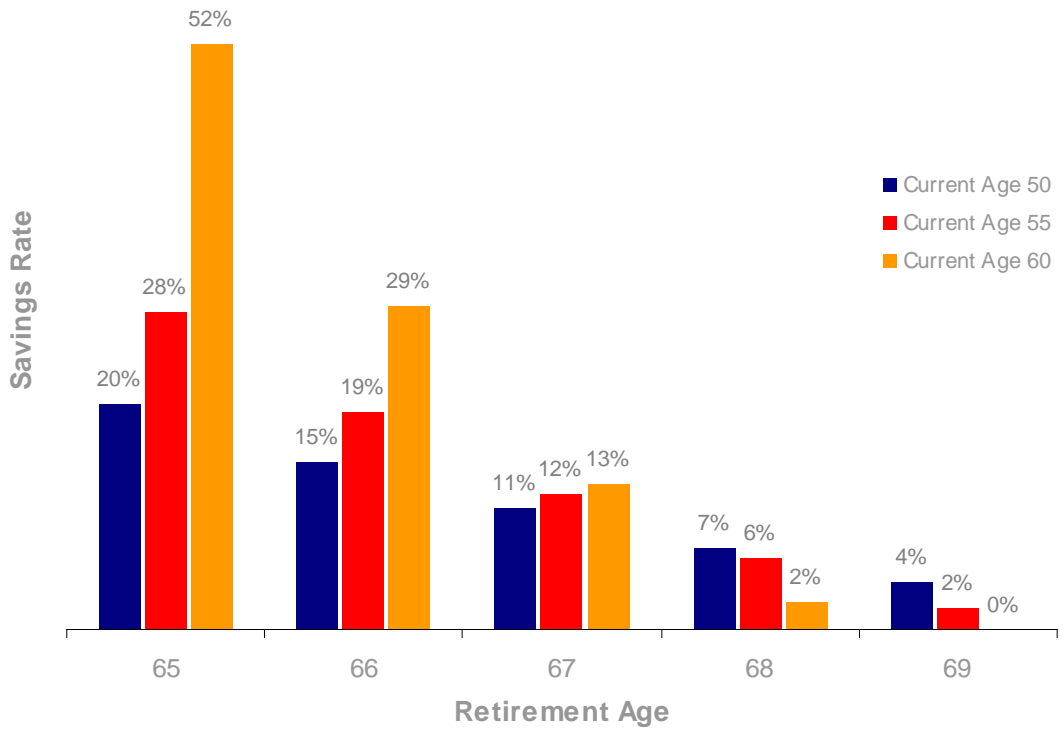
FIGURE 3

$75,000 Salary Post-Drop Break-Even Retirement Savings Rates
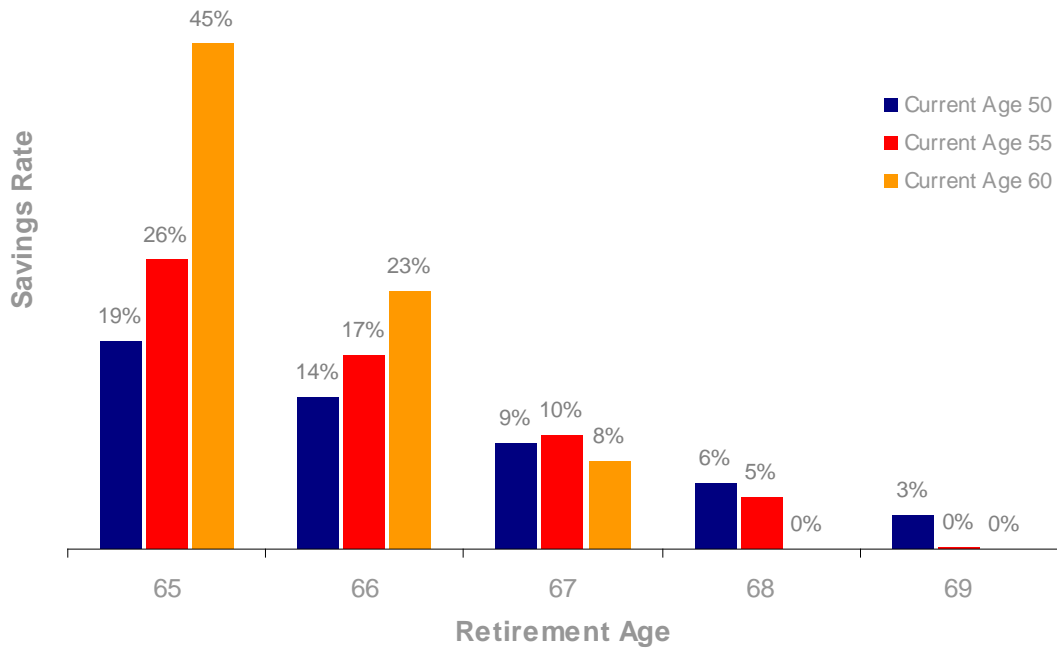
The results for sample workers earning $75,000 per year are similar to those for sample workers earning $50,000 per year—delaying retirement has a very large impact, especially for older workers.

FIGURE 4

$100,000 Salary Post-Drop Break-Even Retirement Savings Rates

For the workers earning $100,000 per year we again see a significant reduction in savings rates as a result of delaying retirement.

Another way of analyzing these results is to assume that the sample workers are either unwilling or unable to increase their savings beyond their current 9 percent rate. In other words, their recovery strategy will consist solely of working longer. Interpolating from Figures 2, 3 and 4, we calculate the new break-even retirement ages. These are shown in Table 10.

TABLE 10

Post-Drop Break-Even Retirement Ages (With 9% Contributions)

	SALARY		
	$50k	$75k	$100k
AGE 50	66.5	67.1	67.5
55	66.7	67.2	67.6
60	66.4	66.9	67.4

Within each age category (reading across a row) the retirement age increases monotonically with salary (i.e., higher-income workers will have to work longer). This is to be expected, as we previously noted that higher-income workers receive a smaller percentage of their retirement income in the form of "fixed" Social Security payments, and consequently must fund a larger percentage of their retirement incomes from their own savings.[13]

In summary, in order to overcome the market downturn of 2008, the sample workers will have to delay retirement until ages 66.5 to 67.6, which translate into 1.5 to 2.6 additional years of work. While not inconsequential, these are a far cry from the "never able to retire" scenarios feared by some workers, and these delays can be mitigated by also increasing savings.

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[13] The retirement age does not increase monotonically across (current) age categories (reading down a column). This is due to nonlinear countervailing influences on portfolio values and resulting retirement incomes. For example, younger workers will have more years of future savings, which were unaffected by the downturn, resulting in *higher* expected portfolio values and retirement incomes. Conversely, younger workers will experience a *lower* increase in expected growth by delaying retirement by one year as the risk (and expected return) "glide path" levels out as the years to retirement increases.

Part 3—Digging a Deeper Hole

It is common for investors to respond to a severe market downturn by seeking to protect their remaining assets, often by moving them into instruments they view as extremely safe and conservative. While this reaction is understandable, it can have a very negative impact on an investor's future wealth. To illustrate this, we again look at the nine sample workers, and evaluate the impact on their forecast retirement incomes were they to switch to all-cash portfolios[14] at the end of 2008,[15] and retain these all-cash allocations until retirement.[16]

We begin by recomputing the probability of reaching the retirement income goal (70 percent of preretirement salary) for each of the sample workers. Results are shown in Table 11.

TABLE 11

Post-Drop Probability of Reaching Retirement Income Goal (All-Cash Portfolios)

		SALARY		
		$50k	$75k	$100k
AGE	50	< 5%	< 5%	< 5%
	55	< 5%	< 5%	< 5%
	60	< 5%	< 5%	< 5%

The results are dramatic. All of the sample workers have very little chance of reaching their retirement income goals if they switch to all-cash portfolios. This does not mean they will have no retirement income, though. Rather, it shows that it is extremely unlikely that their income will reach their goal of 70 percent of their preretirement salary.

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[14] The all-cash portfolio has 100% of holdings invested in a money market fund.

[15] On December 31, 2008 the S&P 500 closed at 903.25, a drop of 42.3% from its peak of 1,565.15 on October 9, 2007. Markets continued to drop in 2009, reaching a low of 676.53 on March 3, 2009. Thus, using the 2008 end-of-year closing value gives us a conservative estimate of the impact of panic as we are not assuming investors sold at the bottom of the market. Additionally, many investors reevaluate their portfolio holdings on an annual basis, so the calendar year-end is a logical time at which to assume a change in holdings.

[16] It is important to note that our analysis assumes that returns from 2008 onwards are consistent with historical average returns and return distributions. Were actual returns for 2009 incorporated (e.g., +23.5% for the S&P 500 Index), the difference between diversified age-appropriate portfolios and all-cash portfolios would be more dramatic. In this regard, our analysis errs on the side of conservatism and is likely to understate the true cost of panic.

To more accurately assess the shortfall, we calculate the median forecast retirement incomes for the all-cash portfolios. We then calculate the differences in median forecast retirement incomes between these all-cash portfolios and the corresponding diversified age-appropriate portfolios. These differences are the incremental "cost of panic," over and above the impact of the 2008 market drop. The percent differences are shown in Table 12.

TABLE 12
Change in Median Forecast Retirement Income from Switching to All-Cash Portfolios
(End of 2008) (% of Pre-Drop Forecast)[17]
(New Median Forecast Retirement Income Below)

		SALARY		
		$50k	$75k	$100k
AGE	50	-9% $ 27,800	-11% $ 38,200	-13% $ 48,100
	55	-6% $ 28,500	-8% $ 39,800	-9% $ 50,700
	60	-3% $ 30,400	-4% $ 43,100	-4% $ 55,000

From Table 12, we see that switching to all-cash portfolios will reduce the sample workers' median forecast retirement incomes by an additional 3 percent to 13 percent over and above the 10 percent to 19 percent reduction due to the market drop of 2008.[18] In no case does switching to an all-cash portfolio improve a sample worker's forecast retirement income.

It is useful to also look at these figures in terms of our recovery strategies—namely, how much additional savings and/or how many additional years of work are required to compensate for the "safety" provided by the all-cash portfolios? The additional savings required[19] are shown in Table 13, and the additional years of work required[20] are shown in Table 14.

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[17] Figures are calculated as the percent decrease from the start of 2008 (pre-drop) values. For example, for Age 50 - $50,000 salary, the calculation is -$3,200 / ($50,000 × 70%) = -9%. The reported percentages would be higher if we used the end of 2008 (post-drop) values in the denominator.
[18] The 10% to 19% figures are from Table 6.
[19] Assuming no additional years of work.
[20] Assuming no additional savings.

TABLE 13
Additional Savings Required as a Result of Switching to All-Cash Portfolios
(Total Savings Required Below)

		SALARY		
		$50k	$75k	$100k
AGE	50	9% 25%	11% 30%	12% 33%
	55	9% 31%	12% 38%	13% 42%
	60	9% 45%	12% 57%	14% 67%

Savings rates will have to increase by 9 percent to 14 percent in order to overcome the lower forecast returns of the all-cash portfolios, with the average increase being 11 percent. These increases are *over and above* the higher savings rates required to recover from the market downturn of 2008 (as shown in Table 7).

TABLE 14
Additional Years of Work Required as a Result of Switching to All-Cash Portfolios
(New Retirement Age Below)

		SALARY		
		$50k	$75k	$100k
AGE	50	1.7 68.2	2.6 69.7	4.0 71.5
	55	1.2 67.9	1.9 69.1	2.4 69.9
	60	0.5 67.0	1.0 67.9	1.4 68.7

Switching to all-cash portfolios will require from 0.5 to 4.0 years of additional work to overcome the lower forecast returns, with the average increase being 1.8 additional years. Similar to Table 13, these delays are *over and above* the increased retirement ages required to recover from the market downturn of 2008 (as shown in Table 10).

Similar to Table 7, we find that within each age category (reading across rows) the "penalty" (whether in the form of increased savings or additional years of work) increases monotonically with salary. As before, this is attributable to the fact that higher-income workers

have to fund a greater percentage of their retirement income from personal savings (as opposed to from "fixed" Social Security payments), and as such were hurt more by the downturn.

Unlike Table 7, we find that within each income category (reading down columns) the penalty *decreases* monotonically with age. In other words, younger workers are hurt more by switching to all-cash portfolios. Although not immediately obvious, this does make sense in light of the four components of a sample worker's retirement wealth: (1) current assets, (2) growth of current assets, (3) future contributions, and (4) growth of future contributions. Growth plays a more important role in younger workers' portfolios than in older workers' portfolios, thus switching to an all-cash portfolio and reducing future expected growth will impact younger workers more severely.

In summary, switching to an all-cash portfolio may appear to be a comforting alternative after experiencing a market drop. Unfortunately, such a decision is likely to do more harm in the long term, as the lower forecast growth of such a portfolio significantly reduces forecast retirement income. This is especially problematic for younger workers, who will suffer more years of sub-optimal growth. For the sample workers, panicking and moving to an all-cash portfolio will cost them an average of 11 percent in additional savings or 1.8 years of additional work.

One caveat to this analysis is that we are assuming workers who panic and switch to all-cash portfolios remain in those portfolios for the remainder of their investing careers. It is likely that many of these workers will eventually return to diversified age-appropriate portfolios. Depending on the timing of their reallocations (and any subsequent returns to all-cash portfolios) the impact on their retirement outlook may be more or less severe than our analysis indicates.

Conclusion

In this paper we analyze the impact of the 2008 market drop on the portfolios and retirement prospects of nine sample workers intended to represent a cross-section of the older American workforce. The market drop of 2008 had a serious impact on all of the sample workers' portfolios, with balances decreasing an average of 27 percent, median forecast retirement incomes decreasing an average of 15 percent, and probabilities of reaching retirement income goals decreasing an average of greater than 45 percent. Higher-income workers were hurt more, as a smaller portion of their retirement income will be provided by "fixed" Social Security payments. Our sample workers were in diversified age-appropriate portfolios at the start of 2008, and the impact of the market drop would have been larger for workers who held unnecessarily risky portfolios at the start of 2008.

We evaluate two key recovery strategies: save more or work longer. In order to recover from the 2008 market drop, the sample workers would have to increase their savings significantly. The new savings rates range from 16 percent to 52 percent of their gross incomes, with older and higher-income workers requiring the greatest increases. Thus, saving more is a feasible solution only for the youngest, lowest-income workers.

If workers choose to work longer instead, they will have to delay retirement by 1.4 to 2.6 years, with higher-income workers facing the longest delays. Although these are not trivial delays, they are a highly effective means of recovery, and are essential for older, higher-income workers for whom the required savings increases are not a viable option.

For many workers, a mixture of the two recovery strategies (i.e., save a little more and work a little longer) may be the most comfortable approach. This is especially true for those individuals who may have a limited ability to delay their retirement age.

We also evaluate the impact of panicking and switching to an all-cash portfolio at the end of 2008. Such actions will require workers to save an additional 11 percent on average, or work for an additional 1.8 years on average, with youngest workers requiring the greatest increases. Thus, panicking will substantially exacerbate the negative effects of the 2008 market drop, making a bad situation even worse. In fact, in some cases the extra years of work required are greater than those due to the market drop of 2008 itself.

Although our analysis uses the market drop of 2008 as the setting, the findings can be generalized to provide advice for dealing with any market downturn. First, being in a diversified age-appropriate portfolio and making ongoing, regular contributions is a good foundation. Second, while being able to increase contributions is a valuable recovery tool, it is far more valuable to be able to continue working past one's planned retirement age. Finally, panicking and moving into an all-cash portfolio after a market downturn will only make a bad situation worse, especially for younger workers.

Appendix I—Assumptions

Current Age	50, 55 or 60
Annual Salary	$50,000, $75,000 or $100,000
Planned Retirement Age	65
Salary Increases	0%
Social Security Payments	$18,600 to $38,700 based on current age, retirement age and income
Current Savings Rate	6%
Company Match	50% to max. of 3% match
Retirement Income Goal	70% of final salary
Probability of Reaching Goal	50% (premarket decline)
Gender	Male
Mutual Fund Provider	Vanguard

Appendix II—Methodology

The diversified age-appropriate portfolios for the sample workers were constructed using Financial Engines' proprietary optimization and simulation software. The first step in this process involved using Financial Engines' Optimization Engine to construct diversified age-appropriate portfolios that would provide the maximum expected returns at an appropriate risk level for each of the sample workers. These portfolios become less risky as the sample workers approach retirement.

The Optimization Engine takes into consideration the costs, quality and investment styles of the specific investment alternatives available (for our analysis we use Vanguard mutual funds, as described in footnote 4). Specifically, the investment allocations take into consideration for each fund the mix of asset class exposures; fund expenses; turnover; fund-specific risk, due to active management or tracking error; and manager performance and consistency to construct a personalized portfolio recommendation for each sample worker. The calibration of this model is based on more than a decade of research into the factors that influence investment performance. Notably, this approach does not rely on market timing. The models are calibrated to reflect the consensus market expectations built into the observed holdings of the market as a whole.

The second step of the process utilizes Financial Engines' Simulation Engine. This is a proprietary Monte Carlo Simulation Engine that provides a view of the potential range of future values for the sample workers' portfolios under a variety of economic and financial conditions. The output of the Simulation Engine is used to determine the pre-drop required portfolio balances, the post-drop probabilities of the sample workers being able to reach their retirement income goals, and the break-even savings rates and retirement ages. To calculate the forecast retirement income, the Simulation Engine assumes that the entire portfolio balance is converted into an inflation-indexed life annuity upon retirement. This conversion allows us to combine portfolio values and Social Security income into a single, annual retirement income projection.

Social Security payments are estimated deterministically, using the current salary as the starting point. Past earnings are backfilled using the historical earnings growth rates exhibited by the sample workers' age cohorts. Future earnings (until retirement) are projected by applying a specified growth rate.[21] Past and future earnings are combined with the retirement age and date of birth to produce an estimated Social Security payout.

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The opinions expressed herein are those of the authors and not necessarily those of Financial Engines, Inc.

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[21] A zero salary growth rate (net of inflation) is used in this study.