Sequence of Returns

ACCESSING AND MITIGATING RISK AMONG DIVERSE INVESTORS

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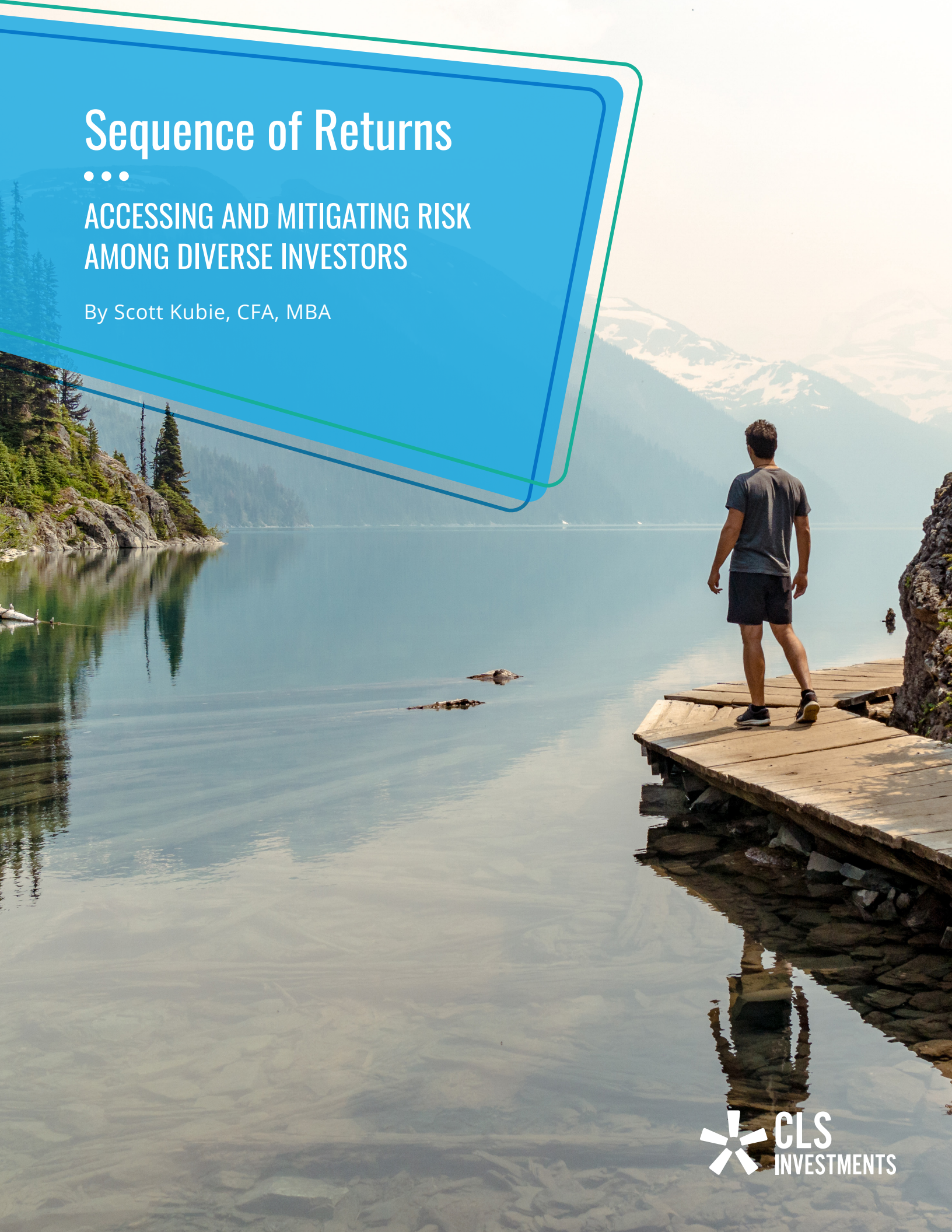

CLS INVESTMENTS

Because of cuts in government retirement plans and elimination of workers' pension plans, investors are taking on more responsibility for their financial futures now more than ever. However, the disparity among the investing public is great; some workers are contributing to their 401k for the first time, while others have been diligently saving in their retirement plans for years, are close to retirement, or are using withdrawals to meet their daily expenses.

The purpose of this paper is to analyze the various types of risk these diverse investors are facing and how different strategies might be used to mitigate that risk. In order to better understand the interaction between market returns, investment strategy, and cash flow, this study created seven initial hypothetical clients. One took no withdrawals, four took varying levels of withdrawals, and two made modest contributions to their accounts. For simplicity, the only asset included in the portfolios is an S&P 500 Index fund. Information about the clients is summarized in Table 1.

Table 1

Client	Description	Average Value excluding Market Impact	Starting Value	Annual Contribution/ Withdrawal	Contribution or Withdrawal Percent (of starting value)
Client 1	No Cash Flow	$250,000	$250,000		
Client 2	Low Withdrawal	$250,000	$265,000	($5,000)	-1.9%
Client 3	Moderate Withdrawal	$250,000	$280,000	($10,000)	-3.6%
Client 4	High Withdrawal	$250,000	$295,000	($15,000)	-5.1%
Client 5	Very High Withdrawal	$250,000	$340,000	($30,000)	-8.8%
Client 6	Low Contribution	$250,000	$235,000	$5,000	2.1%
Client 7	Moderate Contribution	$250,000	$205,000	$15,000	7.3%

Performance results were calculated for the three consecutive seven year periods beginning in 1990 and ending in 2010. A fourth seven year period – from 2002 to 2008 – was included as well. As illustrated in Table 2, the three consecutive periods had very different equity market returns: the first period produced a high return, the second a mediocre return, and the third a below average return. The period ending in 2008 represents the worst seven year stretch in recent years.

Table 2

Period	Returns	
1990-1996	Annual Returns	14.4%
	Non-Annual Returns	156.7%
	1990	-3.1%
	1991	30.5%
	1992	7.6%
	1993	10.1%
	1994	1.3%
	1995	37.6%
	1996	23.0%
1997-2003	Annual Returns	7.6%
	Non-Annual Returns	66.6%
	1997	33.4%
	1998	28.6%
	1999	21.0%
	2000	-9.1%
	2001	-11.9%
	2002	-22.1%
	2003	28.7%
2002-2008	Annual Returns	-1.5%
	Non-Annual Returns	-10.3%
	2002	-22.1%
	2003	28.7%
	2004	10.9%
	2005	4.9%
	2006	15.8%
	2007	5.5%
	2008	-37.0%
2004-2010	Annual Returns	3.9%
	Non-Annual Returns	30.3%
	2004	10.9%
	2005	4.9%
	2006	15.8%
	2007	5.5%
	2008	-37.0%
	2009	26.5%
	2010	15.1%

Non-annualized returns are included to highlight the actual magnitude of the performance difference. The same effect can be seen in the dollar value returns of the portfolios in the next section. The seven year periods are evaluated separately. Each client had an average balance of $250,000 excluding the impact of market performance. So, an investor withdrawing money starts with a higher balance than one contributing.

DATA CREATION

Rather than analyzing each client's returns against just the historic sequential return for each period, they were shuffled to cover all possible combinations. Each seven year period had 5,040 different return sequences.

Shuffling the returns gives insight into how sequence of returns and volatility impact different investor situations. Only one year between 2004 and 2010 generated negative returns: 2008 (-37 percent). For investors with a sizeable fixed withdrawal, the sequence of return is highly significant. A withdrawal after a very negative first year removes assets that would have helped the portfolio recover. If the negative year occurs in the last year of the period, assets that can absorb the downturn more easily have accumulated. This paper provides additional insight how sequence of returns impacts investors.

Table 3

Years	Names	Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7
1990-1996	Mean	$641,720	$630,308	$618,896	$607,485	$573,250	$653,131	$675,954
	Minimum	$641,720	$614,868	$588,017	$561,165	$480,611	$640,547	$638,202
	Standard Deviation	$0	$5,793	$11,586	$17,379	$34,759	$5,793	$17,379
	Tenth Percentile	$641,720	$622,290	$902,861	$583,431	$525,143	$645,634	$653,462
1997-2003	Mean	$416,609	$401,274	$385,939	$370,604	$324,600	$431,944	$462,614
	Minimum	$416,609	$379,134	$341,659	$304,183	$191,757	$416,938	$417,596
	Standard Deviation	$0	$7,945	$15,890	$23,835	$47,971	$7,945	$23,835
	Tenth Percentile	$416,609	$390,306	$364,002	$337,698	$258,787	$422,074	$433,002
2002-2008	Mean	$224,366	$208,194	$192,023	$175,851	$127,335	$240,538	$272,881
	Minimum	$224,366	$190,701	$157,037	$123,372	$22,378	$228,297	$236,159
	Standard Deviation	$0	$6,514	$13,027	$19,541	$39,082	$6,514	$19,541
	Tenth Percentile	$224,366	$198,854	$173,341	$147,829	$71,292	$232,294	$248,151
2004-2010	Mean	$325,366	$309,694	$293,700	$277,706	$229,723	$341,682	$373,671
	Minimum	$325,366	$293,624	$261,560	$229,495	$133,303	$329,553	$337,282
	Standard Deviation	$0	$7,198	$14,397	$21,595	$43,191	$7,198	$21,595
	Tenth Percentile	$325,366	$299,185	$272,682	$246,179	$166,670	$332,742	$346,848

RETURNS MATTER

The summary results table (Table 3) for the seven clients' returns provides a number of valuable insights. First, return matters. For each client, the minimum return in the bullish first period is higher than the maximum return in any other scenario (maximum data is not included in the table.).

CONTRIBUTIONS DAMPEN VOLATILITY IMPACT

When comparing clients, Client 7, who has the highest contribution percentage, has the highest ending value in each scenario. Even from 2002 to 2008, Client 7 finishes with a balance above the $250,000 breakeven level. The better results are a consequence of dollar cost averaging, as contributions act to smooth out swings in the market. Clients taking withdrawals have the lowest balances in every scenario.

CASH FLOWS MAGNIFY THE IMPACT OF RETURN SEQUENCE

The level of withdrawal or contribution also impacts the range of results around the average. Only Client 1 has the same results in every return sequence. The contribution level can even add enough volatility to overcome the benefits of dollar cost averaging. While the average return is the highest in each scenario for the high contribution client (Client 7), the minimum return in the first period is lower than the minimum for Client 6, who contributes at a lower percentage.

The standard deviation of the ending dollar value gives the clearest picture for the consistency of client results around the mean. When clients contribute or withdraw a larger percentage of the current balance, the final value for the account becomes more volatile. Put more simply, the sequence of returns matters more when the cash flow percentage is larger.

WITHDRAWAL MINIMUMS ARE CONTRIBUTION MAXIMUMS

Further research into the return streams shows that the minimum balance for withdrawal clients occurs when returns move sequentially from lowest to highest. A fixed withdrawal level forces the investor to sell a larger percentage of the remaining account when prices drop. When the market rallies, the remaining balance has already been depleted by the withdrawal. When a bad sequence is coupled with a bad initial seven year return, a client's assets can be drained very quickly. The worst possible return sequence for 2002-2008 is for Client 5. His or her $30,000 annual withdrawal leaves only $22,378.

However, low return years in the early period are very beneficial to clients still contributing. Additional data analysis reveals the best sequence for Client 7 is the same sequence that delivered terrible results for clients withdrawing money. This is because the initial lower balance results in less of an impact from the negative returns. The contributions are invested at lower prices so, when the market rallies, the contributing client has a much larger number of shares with which to recover.

Contributing investors suffer their worst results when returns move sequentially from highest to lowest. When returns are positive early, the account size is smaller than for other investors. The same sequence is the best scenario for withdrawal investors, because the best returns occur when their balances are the highest.

CONCLUSION FOR CLIENTS 1-7

The evidence from the various return streams indicate that clients contributing or withdrawing assets have special risks that are independent of their subjective risk tolerance. These risks can increase based on the percentage of cash flow. While contributing money smoothes the impact of market returns, contributors are vulnerable to the positive returns occurring before they have their assets fully invested. Withdrawing money leaves an investor more vulnerable to market volatility and negative returns in early periods.

The order or sequence of returns presents an additional risk to those withdrawing or contributing to their portfolio. Client 1 illustrates that clients without cash flows are indifferent to return order; their results are the same regardless of order. These risks are different than simply gauging an investor's ability to withstand volatility. The next sections will explore possible solutions to these risks in greater detail.

LEVERAGE

In order to understand the sequence of return risks that come with contribution, two additional clients will be introduced. Clients 8 and 9 each have $50,000 balances and contribute $25,000 to their accounts annually. The only difference between the two is Client 9 leverages his account by 30 percent in year one. The amount of leverage then drops by 5 percent each year. By year seven, the leverage has dropped to zero. Table 4 shows the summary statistics for Clients 8 and 9.

Table 4

Years	Names	Client 8	Client 9
1990-1996	Mean	$377,917	$410,241
	Minimum	$314,998	$357,259
	Standard Deviation	$28,966	$25,690
	Tenth Percentile	$340,431	$376,265
1997-2003	Mean	$284,890	$297,667
	Minimum	$209,949	$235,340
	Standard Deviation	$39,726	$36,209
	Tenth Percentile	$235,625	$253,221
2002-2008	Mean	$193,042	$192,641
	Minimum	$131,838	$139,944
	Standard Deviation	$32,568	$30,212
	Tenth Percentile	$151,825	$155,509
2004-2010	Mean	$242,815	$248,639
	Minimum	$182,167	$197,516
	Standard Deviation	$35,992	$33,628
	Tenth Percentile	$198,111	$210,965

Most of the statistics for these two investors match our expectations. Given the larger contribution percentage in early years, it is not surprising to witness a high standard deviation of results for the two clients. When returns are positive, Client 9's leveraging propels his returns above those of Client 8. When markets are down, the leverage leads to larger losses. All of these assumptions play out as expected.

However, upon closer examination, there are a number of surprises. The first comes in the return numbers. During the negative return years of 2002-2008, the leverage is expected to hurt Client 9, but his average ending balance is only $399 below the average for Client 8.

A second surprise is the standard deviation of final asset values. Leverage is expected to magnify variation, but the standard deviation of results is lower for the leveraged client. The high level of contributions seems to interact with the leverage differently than for clients not contributing. A final surprise comes in the minimum results. In every seven year period examined, including 2002-2008, the leveraged investor's worst result is better than the unleveraged investor's.

How does leverage reduce risk in most cases? Leverage can reduce risk by giving the investor more market exposure when balances are low. Remember, contributors' worst results come when the best returns are early. So the risk of the leverage can effectively cancel out some of the sequence of return risk and leaves the investor with a more consistent ending dollar value.

Since the results for the market were based on the S&P 500, the only way to increase risk was to use leverage. If the investor was not fully invested in equities, another option would be to increase the risk of the portfolio in early years and sequentially lower it as time passes.

A survey of questionnaires used by various firms suggests that most firms reduce the risk exposure of the investor for withdrawals. However, very few firms increase the risk of clients making contributions. This is probably driven by the belief that subjective risk tolerance dominates other risks for the contributor. Our analysis suggests reconsidering the current approach. It may be prudent to increase risk levels for accounts making a larger contribution relative to the balance and gradually lower that increased risk as the percentage of the balance contributed decreases.

PROTECTION STRATEGIES

As investors approach retirement, the focus often switches from accumulation to protection. Expectations for retirement firm up and commitments are made so the expectations can become a reality. When plans become more defined, the ability to recover from market volatility declines. Contributions are a lower percentage of the overall balance and are much closer to ending. Investors in this stage are much more sensitive to downturns because the life impact of those downturns is larger and the ability to recover is decreased.

Protection strategies are unique and can be successful in varying degrees. Rather than introducing a detailed protection methodology, for the purposes of this paper, protection strategies are assumed to capture 75 percent of the return of variation from zero with a maximum loss of 15 percent. For example, if markets are up 10 percent, the protection investor will earn 7.5 percent. If markets are down 10 percent, the protection investor will lose only 7.5 percent. Should markets fall 20, 30, or 40 percent, protection clients only lose 15 percent for that year.

Client 10 and Client 11 are introduced as clients who use protection strategies in their portfolio. Client 10 matches Client 4, who withdraws $15,000 each year. Client 11 matches Client 1, who doesn't contribute or withdraw assets from the portfolio.

Table 5

Years	Names	Client 1	Client 10	Client 11	Client 4
1990-1996	Mean	$641,720	$467,316	$506,984	$607,485
	Minimum	$641,720	$437,585	$506,984	$561,165
	Standard Deviation	$0	$11,400	$0	$17,379
	Tenth Percentile	$641,720	$451,622	$506,984	$583,431
1997-2003	Mean	$416,609	$330,709	$375,881	$370,604
	Minimum	$416,609	$288,229	$375,881	$304,183
	Standard Deviation	$0	$16,050	$0	$23,835
	Tenth Percentile	$416,609	$308,957	$375,881	$337,698
2002-2008	Mean	$224,366	$238,035	$284,036	$175,851
	Minimum	$224,366	$208,557	$284,036	$123,372
	Standard Deviation	$0	$11,463	$0	$19,541
	Tenth Percentile	$224,366	$221,692	$284,036	$147,829
2004-2010	Mean	$325,688	$322,113	$366,428	$277,706
	Minimum	$325,688	$297,557	$366,428	$229,495
	Standard Deviation	$0	$10,432	$0	$21,595
	Tenth Percentile	$325,688	$307,485	$366,428	$246,179

Comparing these two pairs of clients helps us understand the impact protection has on the portfolio. For the highly positive return period beginning in 1990, the protection strategy lagged significantly. Client 10's balance lagged Client 4 by approximately $140,000 and Client 11's lagged Client 1's by about $135,000. In the moderate return period starting in 1997 both protection clients' accounts lagged their fully invested counterparts by about $40,000.

In the low return environment, beginning in 2004, protection accounts did much better. Client 10, who is taking withdrawals, had a balance around $45,000 higher than Client 4. Client 11 earned an additional $41,000 over the same period. The advantage gets wider during the negative return period beginning in 2002. Here, the average return for protection adds over $60,000 for both clients. Client 11 finished with a higher balance in 2010 even with the negative years.

The simplistic protection assumptions also tended to narrow the variation of results based on the sequence of returns for clients taking a withdrawal. The variation of results is significantly smaller for Client 10 than Client 4 in all scenarios. The same impact can also be seen in the smaller difference between the mean, minimum, and tenth percentile results. The investor not taking withdrawals receives no additional benefit. His or her results are the same in every scenario.

Looking across periods shows greater consistency in results for protection investors. Client 10's mean in the first period is only $145,000 greater than in the third period. Client 4's gap is $330,000. Similar results are generated when comparing Client 11 and Client 1. Perhaps most importantly, the losses are smaller and the portfolio does better when returns become negative.

It is crucial to keep in mind that the results for protection strategies are very path-dependent. From 2004 to 2010, there was only one negative year (2008) which dropped 37 percent. The protection strategy only lost 15 percent that year, avoiding 60 percent of the downside. If returns are altered to include two negative years that are less severe, while keeping the same 3.85 percent annual return, protection avoids only 25 percent of the downside.

All of these numbers assume the protection strategy will generate 75 percent of the return of a fully invested account capped at a 15 percent loss, but there is no guarantee the protection strategy will perform in this matter. The capture ratio could be 60 percent, which makes protection less attractive in rising markets of any type. Protection strategies also have some vulnerability to flat markets with sharp moves up and down. During such markets, protection strategies may deliver negative results when the market is slightly positive.

CONCLUSION

Investors contributing or withdrawing assets are sensitive to the sequence of returns due to the interaction between cash flows and account size. Sequence of return is an additional risk factor separate from an investor's ability to tolerate volatility.

Investors systematically contributing to their portfolio may want to consider taking more risk than a risk profile suggests so they can have higher risk exposure when balances are low. Raising the risk level early and then leveling it off can lower the variation of the ending account balance.

Investors withdrawing from their portfolio may benefit from using protection strategies, depending on their withdrawal level, their ability to recover from a downturn, and the effectiveness of any protection strategies relative to its costs.

At a minimum, investors making substantial contributions or taking substantial withdrawals and their advisors should make sure they have strategies for managing sequence of returns.

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1026-CLS-8/15/2019