401(k): TAKE CONTROL!

Of Your Mutual Fund Investment Decisions

"What mutual funds should I invest in? How do I know they're the best? Can ***I*** do it?"

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The purpose of ***401(k): TAKE CONTROL!*** is to provide decision-tools to help you select investments from the lineup of mutual funds available in a 401(k) retirement plan. Choosing the right funds adds to income in good times and cushions against losses in down markets. Your goal is to understand fund returns, costs, and risks. Our job is to help.

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Welcome to the World of Investing

Books about 401(k)s often get bogged down in statistics, law, economics, and politics. Some are quite good. Our favorite is *Empire of the Fund*, by William A. Birdthistle. The following is an excerpt that summarizes our country's 401(k) predicament:

> Over the past 30 years, America has embarked on a grand experiment—perhaps the richest and riskiest in our history—to change the way we save. The hypothesis of our experiment is that millions of ordinary, untrained and busy citizens can successfully manage trillions of dollars in a financial system dominated by wealthy, skilled, and powerful investment firms—firms that on many occasions have treated investors shabbily.

The "grand experiment" may have unintended consequences. When individuals learn how to calculate the costs and returns in their 401(k)s and understand the results, their outlook and behavior is likely to rock America to its political core. They will see their future—their wealth and retirement security—inextricably bound to businesses. It's always been true, but more than ever Americans may better understand that capitalism plays a major role in our mixed economy, the partnership of government and free enterprise. They may take control over more than their 401(k)s.

The Genesis of *401(k): TAKE CONTROL!*

Our business offers a 401(k). We believe it is beneficial to employees and us. However, we were troubled by the vague, technical, and inadequate training that 401(k) providers gave our employees.

When we found no books, websites, etc. that offered a relevant and detailed introduction to investing, we wrote *401(k): TAKE CONTROL!* We knew what our employees needed to understand about 401(k) investing. However, we didn't assume we knew how our employees should learn. Like many companies our employees have a wide range of educational backgrounds: high school, bachelor, master, and engineering degrees. We

took our cue from them. Interaction with employees led to development of seminars and this book.

We don't just advise diversification, we explain and exemplify real world consequences of "putting all your eggs in one basket." Furthermore, we don't just discuss return ratios, cost ratios, and risk measures that are given by 401(k) providers and mutual fund managers, we show in detail how to translate them to readily understandable dollars and use them to make mutual fund investment decisions, given *your* personal circumstances. Along the way, our employees were—and we're confident you too will be—WOWED! to learn the huge fees and expenses charged by some mutual funds. Do you know which ones? Our employees learned how to avoid being "treated shabbily" by "powerful investment firms."

Cast

Lydia and Aaron are two employees who search for ways to invest their money. Like millions of 401(k) participants, they are uncertain what to do or even where to start. Lydia was previously burned during a stock-market bubble losing her savings and job. Her colleague, Aaron, is the story's recently graduated math-phobic narrator.

Mutual Fund Managers buy stocks and/or bonds for their funds. The amount they charge investors is expressed as expense ratios, which are stated in *very small numbers, sometimes in thousandths of a percent.* They are difficult to interpret.

Providers, also called **Bookkeepers**, offer employers administrative services. Their fees are stated in very small numbers and are difficult to interpret.

Financial advisors offer individualized investment recommendations. Their costs are stated in very small numbers and are difficult to interpret.

Sponsors are employers. They provide 401(k) opportunities to save pre-tax dollars for retirement. They hire and can fire mutual fund managers and providers.

Participants are employees enrolled in a 401(k). **You.**

CHAPTER 1

Clichés To Live By

Introduction

Not many years ago, an employer secured your retirement with a pension plan that paid "guaranteed" benefits. With these "defined *benefit* pensions," you would know how much money you would get every month for the rest of your life. They might include adjustments for inflation, payments to surviving spouses, even health insurance. Today, such plans are widely considered too expensive, even for governments.[1]

"Defined benefit pensions" are being replaced by "defined *contribution* plans," commonly referred to as 401(k)s. "A 401(k) is a retirement savings plan sponsored by an employer. Workers can save and invest a piece of their paycheck before taxes are taken out. Taxes aren't paid until the money is withdrawn."[2] The Department of Labor recently reported 94.6 million employees participate in "defined contribution plans."[3]

The shift from defined benefit to defined contribution plans means YOU bear the risk of supporting your retirement. If you save enough and invest wisely, you should have money to last through retirement years. However, if you don't plan how much money you'll need, don't save enough, buy investments that don't earn enough, or retire in the middle of a market decline, which, by the way, happens periodically, you could run out of money.

I can almost hear you say, "I don't know anything about investing. I don't know which investments to pick. I don't know how much I'll need for retirement. Besides, I could end up losing all my money. And have nothing for retirement." The truth is you can and must learn. If you don't make investment decisions for yourself, someone else will. Their decisions may not be consistent with your goals or even in your best interests. *Don't expect anyone to be as careful with your investments, your money, as you are.*

Nevertheless, you are fortunate to participate in a 401(k) plan. Your employer is willing to spend time and money to provide a long-range financial opportunity. So, follow along with us, begin or continue to plan for retirement, and learn how to make or improve your investment choices.

"Don't put all your eggs in one basket."

As a participant in a 401(k), you'll typically choose investments from a pre-selected lineup of twenty to thirty mutual funds. Two popular types are *stock* and *bond funds*. A stock fund, also called an equity fund, invests in the stock of many companies. A stock is an ownership interest in a company like IBM, AT&T, or Ford. Stock funds "constituted 42 percent of the mutual fund market in the United States in 2016. The second most popular type is bond funds, with 22 percent of the market share."[4] Bond funds invest in a variety of debt instruments, which include corporate and/or government promises to repay borrowed money. We'll discuss investments in stock and bond funds in Chapters 2 – 4.

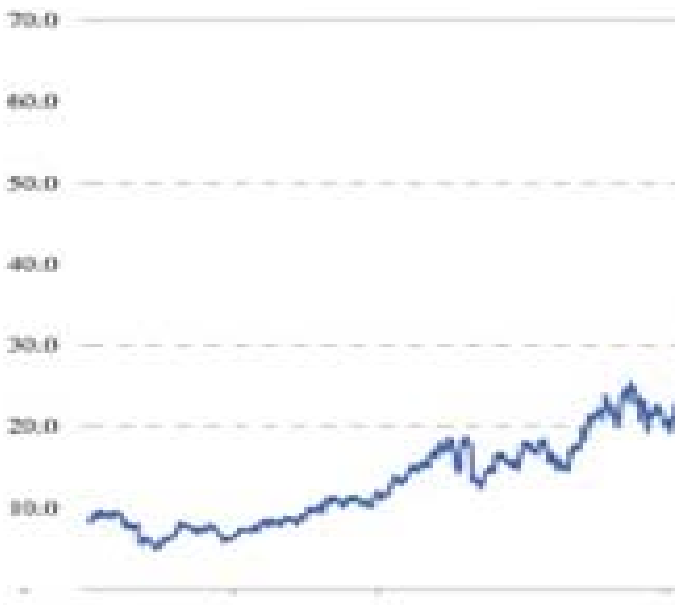
Since the most popular funds invest in stocks, a good place to learn about them is the potential risks and rewards of owning one company's stock. The conventional wisdom is that buying shares in a mutual fund reduces the downside risk of putting all your eggs in one basket, that is, investing all your money in one company's stock. What does this mean? Is it true?

"You Can't Lose. Buy ABC, Inc., Now!"

ABC, Inc. (its real name will be revealed later) is a fast growing company that offered products and services to millions of customers. In addition to earning money, publicly traded companies like ABC raise money by offering millions, sometimes billions, of shares of stock. Anyone could buy its shares. Investors could, and frequently did, resell the shares.

ABC's price history as of January 1998 was chronicled in a chart.

ABC, Inc. Per Share Prices, 1994 - 1998



Jan 1994 Jan 1995 Jan 1996 Jan 1997 **Jan 1998**

$20

Like most companies' charts, time is represented on the horizontal axis and dollars are on the vertical axis. In this case, dates are from January 1994 until January 1998 and dollars on the vertical axis range from $0 to $70.

As you can see, stock prices change considerably, even over a short time. For example, between late 1996 and early 1998, ABC's price per share changed from about $15 up to $25 then down to $20. Changes in stock price are normal and occur every trading day, all day long. Assume the last date on the chart is today, will the price of ABC go up, down, or remain the same? The chart reminds us that we don't know what's going to happen in the future.

Lydia Invests in ABC, Inc.

Consider what happened to Lydia (not her real name), an intelligent young woman, college educated, but without a background in investing. An acquaintance, John Prentice (not his real name), knew many ABC, Inc. employees including Lydia. John, J.P. to his

friends, was a stockbroker by profession. At the right time and with a glowing news report in hand, he offered Lydia and her friends an investment opportunity.

“ABC recently announced several major mergers and acquisitions. The company is growing by leaps and bounds.”

Lydia had a pretty good idea how fast ABC was growing. She worked in the Personnel Department. As part of her job, she added what seemed like an army of new employees to ABC’s system.

J. P. spoke to her dreams. “ABC is your pathway to wealth and early retirement.” He finished his sales pitch with, “Buy now. You’ll never get it cheaper.”

Lydia was a loyal ABC employee and proud to work for a successful business. Not wanting to be left out of a sure thing and having confidence in her employer, Lydia decided to buy 1000 shares “on the dip”—a temporary market downturn—at the beginning of January 1998. The price per share at the time was about $20.

Sidebar: The exact price of a publicly traded company is listed real-time at a stock exchange. For example, see, http://money.cnn.com/data/hotstocks/index.html. Take a minute to play with the list of companies. Select one of the “Most Actives” you’re familiar with. What’s its current stock price? Has it gone up or down since yesterday? What products and services does it sell? Do you buy them?

As a customer, you know something about a company’s products and services, but that’s just one piece of the investment puzzle. When we discuss mutual funds in later chapters, you’ll see they invest in a variety of companies. If you invest in a fund, you’ll be investing in all its companies.

How much money did Lydia spend on ABC stock? In other words, what did they cost?

Price x Quantity = Stock Value (Jan 1998)
$20 x 1000 = $20,000

Sidebar: Price-times-quantity is an idea you use daily. If you buy twenty gallons of gasoline at $2.93 each, the total cost is $58.60. However, some language used by finance professionals may seem obscure. For example, “stock price,” “stock cost,” and “stock value” may be used interchangeably.

At the time, $20,000 was most of Lydia’s savings, but she expected the price to go up. J.P. seemed sure and Lydia had confidence in her company. In a quiet moment, a few days later, doubt crept into her thoughts. “$20,000 is a lot of money.”

Does Lydia *know* the price of ABC stock will increase? Regardless of what J.P. promised—or seemed to promise—the answer is, no. No one does.

Sidebar: Financial analysts—also known as investment experts—conduct market research. They review publicly available information and offer opinions. Even though they use the latest investment buzzwords and sophisticated mathematical models to make predictions, they don’t know whether a particular stock’s price will rise, fall, or stay the same.[5]

An easy way to confirm they are making predictions is to ask for a written guarantee the price of their recommended stock, bond, or mutual fund will go up. You’re likely to be referred to the prospectus. It’s a written document given to potential buyers, which specifies the purpose of the investment, cost, persons involved with the business, and a statement of risk. Every prospectus will state some version of the following: *Investing in [company or fund name] involves risk. Shares, when sold, may be worth more or less than the original purchase price.*

From time to time, Lydia checked her investment’s progress. By June 1999, ABC looked like a dream come true. It was exciting!

The market price went up and down during 1998 and 1999 but mostly up. By June 1999, ABC's stock was selling for about $65 per share.

Lydia couldn't help having a fleeting, regretful thought: "I wish I'd bought more."

What's her investment worth as of June 1999?

Price x Quantity = Stock Value (June 1999)
$65 x 1000 = $65,000

How much has Lydia's stock price increased?

Stock Value (June1999) - Stock Value (Jan 1998) = Gain or Loss
$65,000 - $20,000 = $45,000 Gain (Unrealized)

Since Lydia didn't sell her shares, she has not realized the gain. The $45,000 increase in stock value is ***un****realized*.

She felt good, and smart, too. All she did was buy 1,000 shares, held them, and amazingly made $45,000…. Or has she? What's missing before Lydia can be assured that the $45,000 gain is hers?

Lydia must sell her shares.

Sidebar: The stock market is often referred to as a liquid market. A discount brokerage could have sold Lydia's shares at the prevailing market price for a flat fee of $5 to $7. (J.P. charges more than a discount brokerage.) Compare selling stock with selling a house. It may take an unpredictable amount of time, maybe months, with the realtor typically being paid as much as 6% of the sales price at closing, usually thousands of dollars.

If she had sold her stock in June 1999, she would have gotten $65,000 in cash, which would have included her original investment of $20,000 and the $45,000 increase in value.

Sidebar: The $45,000 is often referred to as a return ***on*** investment and the $20,000 is referred to as a return ***of*** investment. Lydia wants return on investment and return of investment, but she may not always get both. Or either. She may also earn a return on investment by way of dividends. Dividends may be paid in cash or shares of the company's stock. However, a company doesn't have to pay dividends. Companies pay dividends to induce people to invest in their stock.

Lydia was doing so well she didn't consider selling her stock. Let's pretend she asked herself, "If I sell the stock, what might I do with the money?"

She could have sold some or all of her ABC stock and used the money to buy other stocks and bonds or made a down payment on a house.

None of these alternatives crossed Lydia's mind. ABC stock seemed phenomenal and everyone said, "Its run up was only the beginning."

J. P. called Lydia. "I told you ABC was a winner! You can make more money here. Let me put in an additional order for you. Another 1,000 shares?"

"I'm short of cash."

J.P. was ready for that. "Buy on margin. It's easy."

"What's that?"

"Borrow the money—our brokerage firm will lend it to you—and you use the stock as collateral."

"Is it risky?"

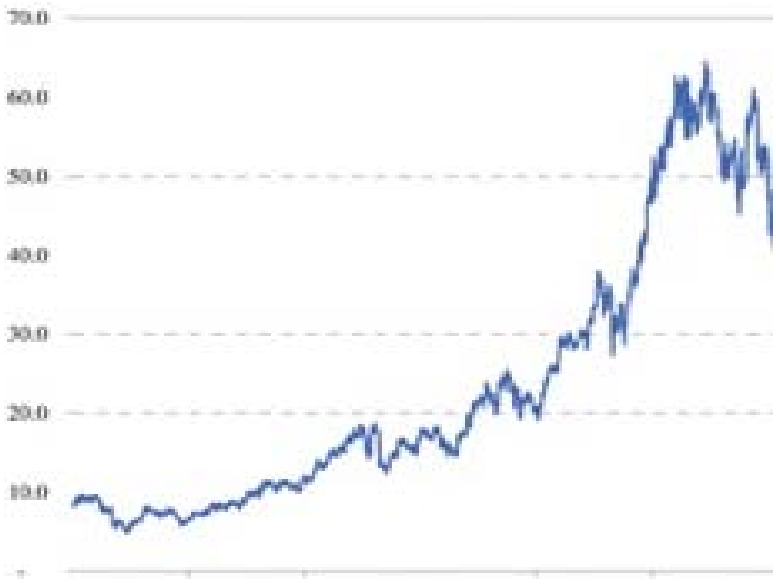
"Not if the stock goes up. And that's what ABC is poised to do."

Sidebar: Lydia had experienced only increases in the value of her stock. She didn't ask what would happen if the stock price went down. If she bought stock on margin and the market price fell below the contract price, she would get a margin call to deposit cash or additional securities in her account. If she couldn't make the deposit, the brokerage firm could sell her stock at the existing market value. If the sale didn't cover the loan, Lydia's personal assets could be at risk. Buying stock on margin can be risky.[6]

Lydia was tempted. "I'll think about it." She was paying down credit card debt and learning how expensive borrowed money could be.

Lydia went back to work, secure in her belief that ABC stock was an excellent investment. She was also determined to save more money to invest. It seemed like a great way to make money and retire early.

In January 2000, Lydia thought it might be fun to see how ABC was doing.



Jan1994 Jan1995 Jan1996 Jan1997 Jan1998 June1999 **Jan2000**

$40

Bad news. ABC's stock had dropped from about $65 to $40 per share. She'd heard gossip in the office, but that was nothing new. There was always office gossip, which included the market gyrations of ABC's stock price. She checked the business news to see if she could understand what was happening. The entire stock market was in turmoil. She could not isolate what was causing the decline in ABC's stock price.

She wondered, what's the total value of my stock, now?

Price x Quantity = Stock Value (Jan 2000)
$40 x 1000 = $40,000

More importantly, Lydia quickly crunched the numbers to see how much money she was making now?

Stock Value (Jan 2000) – Stock Value (Jan 1998) = Gain or Loss
$40,000 - $20,000 = $20,000 Gain (Unrealized)

“Okay, I’m still making lots of money.”

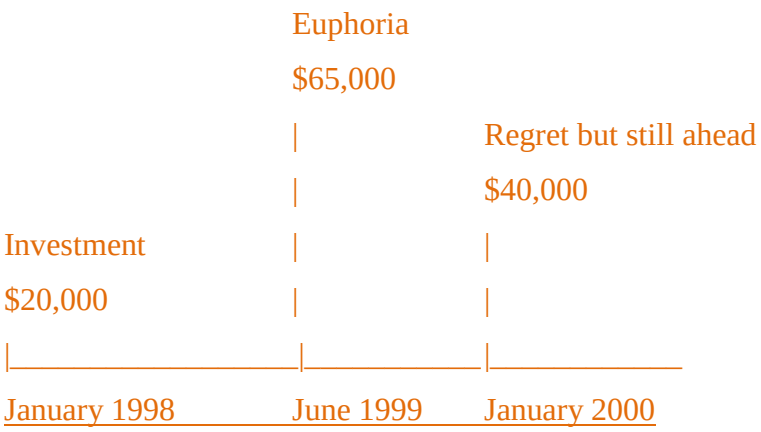
But that was only part of the story. Just six months earlier, in June 1999, Lydia could have had $65,000 in cash. How much money did she miss out on by deciding to hold the stock?

Stock Value (Jan 2000) – Stock Value (June 1999) = Gain or Loss
$40,000 - $65,000 = -$25,000, a Loss (Unrealized)

Since June 1999, her unrealized loss was $25,000. Lydia was disappointed. Even though she never really had the $65,000 in cash, she could have. It felt like a “real” loss.

Lydia was learning. Investing is unpredictable and creates feelings of euphoria and regret.

Sidebar: The market value of Lydia’s investment swung from an initial amount of $20,000 (January 1998) up to $65,000 and an unrealized gain of $45,000 (June 1999)—EUPHORIA. Then it dropped to $40,000 and an unrealized loss of $25,000 from the high of $65,000—REGRET. Even so, the value of Lydia’s stock was now double her original investment of $20,000—PHEW! Veering from euphoria to regret can happen to you, too.[7]



J. P. called Lydia for a little hand-holding and marketing. “What goes down must go up. A few months ago, ABC was at $65. Every one knows it’s going to acquire Omega Company. That’s going to move the stock up, up, up. What do you say? Ready to buy another 1,000 shares on the dip?” When she didn’t answer immediately, he offered, “Or at least 500 shares?”

Although Lydia was still making money on her stock, the recent drop worried her. She wondered, should I sell some or all? Or buy more? Or stand pat?

“I’ll stay with my 1,000 shares for the time being,” she told J.P.

With her hard-earned money at risk, Lydia was determined to study business and investing. Unfortunately, much of financial news seemed like it was written in a foreign language.

In September 2000, a TV personality and host of the popular *FinanceReport* was abuzz with good news: “ABC’s slaughtering the competition and we have its CEO here tonight to tell us all about it.” A familiar gray haired man, every inch the leader of a successful company, was literally oozing with confidence as he painted a rosy picture of the company’s future. The familiar images of ABC’s vast high-tech facilities teeming with energetic employees underscored his optimism.

Lydia pulled up ABC's chart. "Oh my, it's popped up, again." Her unrealized gain had increased to $30,000."

At $50 per share, the TV personality assured the audience that "ABC has the right leadership and is headed in the right direction."

As if on cue, J. P. called. "ABC's poised to go up! It was selling for $65 just a little while ago and is on its way up, again. How about another 500 shares? Or at least 300 shares?"

It was tempting. Lydia remembered the euphoria in the wake of ABC's run-up in value but wondered if buying more was really a good idea. "I'll have to think about it, J. P."

Lydia studied what everyone claimed were reliable sources: *The Wall Street Journal*, *CNBC*, *FoxBusiness*, and the company's financial reports. Some financial news commentators were positive ABC's stock would go up; others seemed just as sure it would go down. Overall the reports seemed positive. In need of facts, not just opinions, Lydia reviewed ABC's financial statements. While they were complicated with page after

page of details and footnotes, they reported billions of dollars in assets and income. Its independent auditors, Certified Public Accountants, said ABC's financial statements were fairly and appropriately presented in compliance with Generally Accepted Accounting Principles. ABC's auditors were among the biggest, most respected, international accounting firms.

The audit report tipped the balance in favor of buying more ABC stock. Lydia had confidence in the auditor's opinion. With a recent inheritance, she took a deep breath, called J.P., and ordered another 1000 shares.

After she purchased the shares, Lydia figured the cost of her investment.

($20 x 1000) + ($50 x 1000) = $70,000
[Price (Jan 1998) x Quantity (Jan 1998)] + [Price (Sept 2000) x Quantity (Sept 2000)]

She also wanted to know the market value of her ABC shares as of September 2000.

($50 x 1000) + ($50 x 1000) = $100,000
[Price (Sept 2000) x Quantity (Jan 1998)] + [Price (Sept 2000) x Quantity (Sept 2000)]

Lastly, she wanted to know what her gains or losses were.

$100,000 – $70,000 = $30,000 Gain (Unrealized)
Stock Value September 2000 – Stock Value at Cost

In spite of the roller coaster ride, Lydia was proud to say, "ABC is my company."

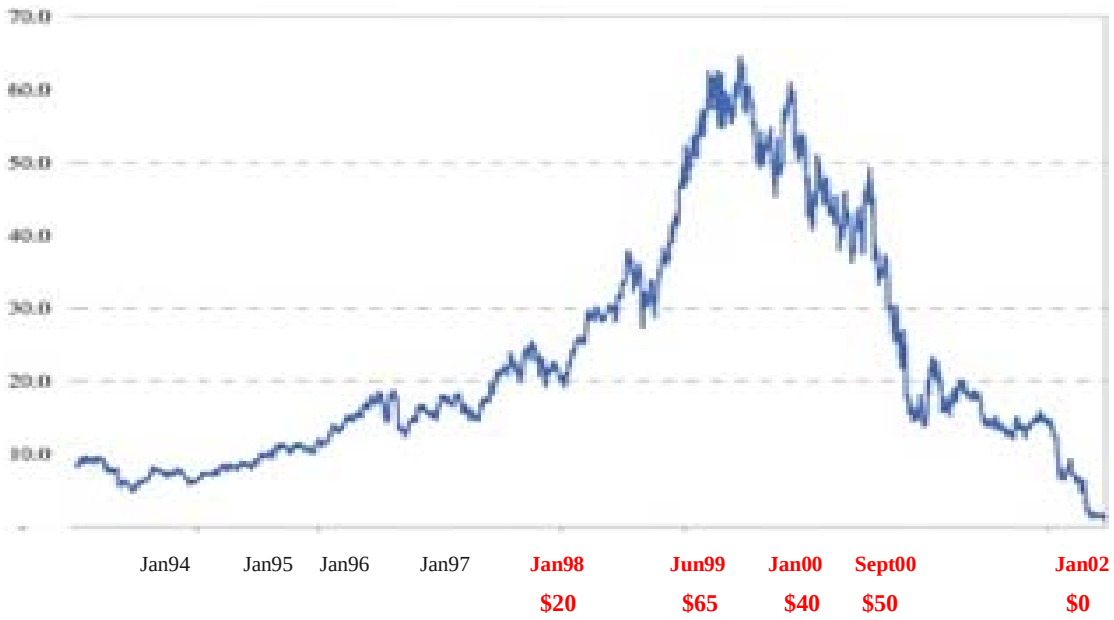
Lydia has a life

Lydia worked hard and advanced in ABC's Personnel Department. She also met a fellow, fell in love, and got married. Soon, a baby was on the way. Monitoring the stock market wasn't her highest priority until early in 2002 when she needed some cash. Lydia knew it probably wasn't a good time to sell because tech stocks were having a hard time. But she was hopeful she wouldn't have to sell all of her stock–maybe just enough to pay some unexpected bills. Never in her wildest dreams did she anticipate what had happened.

Sidebar: During the period of 1997 to 2001, excessive stock market speculation occurred in the dot.com, technology, and telecom industries. Stocks soared higher and higher. ABC was among these companies. Between 2000 and 2002, the tech "bubble burst."

There's nothing new about investment "bubbles." Even Sir Isaac Newton couldn't resist the lure of quick money. The South Sea Bubble burst in the early 1700s costing Sir Isaac and much of the rest of England a fortune.[8]

ABC's chart "said" it best.



Instead of gains, Lydia's ABC stock was selling for less than two dollars per share. Most of her hard earned $70,000 had evaporated along with the unrealized gains for a total of nearly $100,000.

ABC, Inc.'s real name is WorldCom.

Sidebar: During the boom, WorldCom had shined as a promising telecom, outperforming even AT&T. Now, WorldCom is synonymous with financial fraud.[9]

What happened?

Behind the scenes, WorldCom had fabricated its financial condition. Its auditors failed to detect the fraud even though WorldCom's financial reports included billions of dollars in assets and income that ***never existed***.[10] [11] [12] It was, according to the *New York Times*, "a shell game."

The unfortunate truth is auditors rarely catch fraud, even big ones like WorldCom.[13] [14] [15]

Lydia might have sold some or all of her WorldCom stock. Instead, she hoped the stock price would go back up. Her belief in the company, what she knew of it, was positive right up to the end. Before its CEO, Bernie Ebbers, was tried, convicted, and jailed, he insisted WorldCom would recover. Many people believed him.[16]

WorldCom filed for bankruptcy. The company was liquidated. Its stock was worthless. Along with Lydia's money, her job was gone, too.

Lydia was not alone. Many WorldCom employees owned WorldCom stock. It was an expensive lesson: investing in a single stock is risky. Working for and investing in the same company magnifies risk. WorldCom employees were not the only losers. Many others, including public retirement funds and university foundations, lost hundreds of millions of dollars.

Sidebar: Instead of cash, your employer may use shares of its stock to make contributions to your 401(k). If your employer uses its stock to fund your retirement plan, you should decide how much you want to keep in your portfolio. If your employer suffers financial reverses, the value of your stock will decline. Typically, 401(k) plans provide an opportunity to diversify by including a variety mutual funds.[17]

Every year thousands of businesses, including well-known publicly traded corporations, file for protection under bankruptcy laws. Some companies reorganize and continue in business. Some companies cease to exist. Among the biggest and best known bankruptcies are Enron, December 2001; Lehman Brothers Holdings, Inc., September 2008; Washington Mutual, Inc., September 2008; General Motors Corporation, June 2009, and Toys R Us, September 2017.[18] [19]

Risk

The variety of securities owned by a mutual fund is intended to insulate investors—you—from single stock risk. A fund, however, does **not** eliminate risk. To lessen the risk associated with a single fund, consider investing in a diverse set of funds. How do you choose the best funds? Follow Lydia and her colleague, Aaron, as they learn how to minimize risk, cope with costs, and earn returns to secure their retirement.

CHAPTER 2

Mutual Fund Performance Data

Mutual Funds

In the United States, there are thousands of mutual funds investing trillions of dollars in domestic and foreign stocks and bonds. 401(k) retirement plans typically offer 20 to 30 funds. Depending on the contract between your employer and the 401(k) provider, one or both of them select a variety of mutual funds in accordance with United States Department of Labor guidelines. Some funds and retirement plans perform considerably better than others. Even with a relatively small number of mutual funds, questions remain: How do you make the best choices? Once you pick your investments, what then?

Lydia and Aaron are about to learn how to pick mutual funds for their individual retirement plans. They had so little knowledge about them, they had never even heard the names. Aaron narrates their journey.

Mutual Fund Performance Data

I'm Aaron. I recently graduated from college. For the first time I have a good job with benefits. I became friends with Lydia when we began work at our new company. She was an experienced personnel manager. Several months after we started, our employer enrolled us in the company's 401(k) plan. It was administered by a provider, National Bank Institutional Services (NBIS), a subdivision of National Bank.

Sidebar: National Bank and NBIS are not real names, but the data we use in this book came from a real bank, mutual fund provider, and 401(k) plan.

As part of the enrollment process, NBIS offered a one-hour seminar for new employees. The instructor was Susan Tilson, Senior Client Consultant and Vice President.

I thought I was following Tilson's discussion, but Lydia's first question told me I had a lot to learn.

“Are our mutual funds FDIC insured?”

Sidebar: Federal Deposit Insurance Corporation is typically abbreviated as FDIC. It is a government-sponsored business that insures deposits in institutions like banks. A purpose of the FDIC is to reimburse account holders, if their bank fails.

The answer caught me by surprise. National Bank was FDIC insured. However, NBIS and the mutual funds were not.

Like most of my co-workers, I was frustrated by Ms. Tilson’s vague descriptions and technical language. Underscoring just how badly the class was failing to provide necessary information, a co-worker raised his hand and shyly asked, “What is a mutual fund?” The question and nods around the room should have clearly communicated to Ms. Tilson that she had wildly overestimated our financial knowledge. But it didn’t. She quickly responded, “It’s a group of stocks and/or bonds owned by an investment vehicle and offered for sale by providers to participants.”

Somebody behind me loudly said, “Huh?”

Ms. Tilson seemed oblivious to our confusion. Many co-workers were more lost than I was and I was really lost!

It got worse. Ms. Tilson handed out a single page, called the *Mutual Fund Performance Data*. It listed thirty-two mutual funds and included a matrix of about 400 numbers, all very small and in very small print.

Mutual Fund Performance Data

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Exp Ratio	Total Return 3 Mo USD	Tot Ret %tile 3 Mos	YTD	YTD %tile	Total Rtn Annlzd 1 Yr	Tot Ret %tile 1 Yr	Total Rtn Annlzd 3 Yr	Tot Ret %tile 3 Yr	Total Rtn Annlzd 5 Yr	Tot Ret %tile 5 Yr	Total Rtn Annlzd 10 Yr	Tot Ret %tile 10 Yr
Vanguard Target Retirement Income Inv	VTINX	0.14	-0.99	65	5.25	40	5.25	40	3.50	10	4.91	31	4.88	9
Vanguard Target Retirement 2015 Inv	VTXVX	0.14	-0.55	76	6.16	57	6.16	57	4.04	15	7.22	32	4.85	3
Vanguard Target Retirement 2020 Inv	VTWNX	0.14	-0.18	50	6.95	28	6.95	28	4.39	3	8.17	12	4.99	3
Vanguard Target Retirement 2025 Inv	VTTVX	0.15	0.11	48	7.48	26	7.48	26	4.53	4	8.86	22	5.00	7
Vanguard Target Retirement 2030 Inv	VTHRX	0.15	0.42	50	7.85	32	7.85	32	4.58	8	9.50	20	4.98	12
Vanguard Target Retirement 2035 Inv	VTTHX	0.15	0.78	54	8.26	34	8.26	34	4.66	11	10.15	18	5.09	9
Vanguard Target Retirement 2040 Inv	VFORX	0.16	1.13	48	8.73	26	8.73	26	4.66	19	10.51	16	5.26	8
Vanguard Target Retirement 2045 Inv	VTIVX	0.16	1.24	49	8.87	28	8.87	28	4.72	15	10.54	20	5.27	10
Vanguard Target Retirement 2050 Inv	VFIFX	0.16	1.25	47	8.85	31	8.85	31	4.72	23	10.54	18	5.27	8
Vanguard Target Retirement 2055 Inv	VFFVX	0.16	1.26	48	8.88	29	8.88	29	4.68	18	10.51	30		
Vanguard Target Retirement 2060 Inv	VTTSX	0.16	1.25	58	8.84	21	8.84	21	4.67	1				
Dodge & Cox Balanced Fund	DODBX	0.53	6.80	2	16.56	3	16.56	3	7.22	3	13.36	1	6.01	19
Dodge & Cox Income	DODIX	0.43	-1.24	3	5.61	7	5.61	7	3.46	17	3.77	11	5.05	16
Vanguard Total Bond Index	VBTLX	0.06	-3.17	90	2.60	63	2.60	63	2.94	41	2.14	71	4.29	52
MFS Value R5	MEIKX	0.51	4.51	77	14.25	51	14.25	51	7.98	24	14.82	12	6.91	16
Vanguard 500 Index Fund	VFIAX	0.05	3.82	44	11.93	27	11.93	27	8.84	6	14.62	16	6.94	23
Harbor Capital Appreciation	HACAX	0.65	-1.94	77	-1.07	84	-1.07	84	6.48	41	13.96	31	8.01	20
Victory Sycamore Established Value	VEVRX	0.63	5.34	72	21.11	25	21.11	25	11.15	3	15.57	16	9.83	3
Vanguard Mid Cap Index	VIMAX	0.08	2.14	90	11.22	73	11.22	73	7.67	34	14.37	39	7.66	39
Artisan Mid Cap	ARTMX	1.19	-4.15	96	-0.89	94	-0.89	94	2.29	79	11.94	47	8.70	16
Diamond Hill Small Cap - CLOSED	DHSIX	1.01	7.90	94	14.45	97	14.45	97	5.03	77	12.93	79	6.96	52
Vanguard Small Cap Index	VSMAX	0.08	6.10	93	18.30	70	18.30	70	7.01	41	14.83	35	8.18	20
AMG Managers LMCG Small Cap Growth	ACWDX	1.36	2.44	59	-5.42	99	-5.42	99	0.23	86	12.21	53		
TIAA-CREF International Eq Idx Instl	TCIEX	0.06	-1.47	32	1.22	42	1.22	42	-1.63	41	6.69	28	0.85	35
American Funds EuroPacific Gr R6	RERGX	0.50	-4.15	25	1.01	21	1.01	21	-0.60	21	7.22	26	2.89	12
Virtus Emerging Markets Opportunities R6	VREMX	1.18	-11.19	97	1.59	88	1.59	88	-0.61	10	1.97	43	4.24	2
T. Rowe Price Real Estate	TRREX	0.76	-1.85	20	6.03	51	6.03	51	12.96	25	11.74	20	4.69	40
Hotchkis & Wiley High Yield	HWHAX	0.95	2.17	24	15.69	19	15.69	19	3.65	42	7.28	16		
Deutsche Enhanced Commodity Strat Insl	SKIRX	0.99	2.26	58	10.98	68	10.98	68	-4.76	7	-4.54	2	-2.10	5
BlackRock Inflation Protected Bond Instl	BPRIX	0.35	-2.35	58	4.11	55	4.11	55	1.51	45	0.55	40	4.27	9

		Exp Ratio	TotalReturn 3 Mo USD	YTD	Total Rtn Annlzed 1 Yr	Total Rtn Annlzed 3 Yr
Goldman Sachs Stable Value	GSSV1	0.25	0.32	1.25	1.25	1.12

I looked at the *Mutual Fund Performance Data* and said to myself, *You've gotta be kiddin' me.* It made me feel like I was standing in the middle of a thick forest at night not knowing which way was home.

It wasn't long before she was interrupted again.

"Which one should we choose?"

"I can't make recommendations, but the *Mutual Fund Performance Data* should help you make your investment decisions."

Lydia was more experienced and braver than most of us: “Can you at least give us an idea what we should look for?”

Ms. Tilson pointed to the handout, “Look at Artisan Mid Cap, ARTMX. It has one of the best ten-year returns at 8.7% and will give you an idea what a well-managed fund looks like. Other than that, NBIS offers investment advice for a small fee. You can find the charges on our website.” Ms Tilson fled before anyone could ask what a small fee meant.

THE DATA

Lydia and I were at a loss how the *Mutual Fund Performance Data*—what we jokingly called *THE DATA*—was supposed to help us pick mutual funds.

Sidebar: *The Mutual Fund Performance Data*, in one form or another, is commonly provided to 401(k) participants.

It included:

(1) Columns 1 and 2—the mutual fund full names and tickers (abbreviations).

(2) Column 3—the mutual fund expense ratios. They state, in percents, how much each mutual fund charges participants per year.

(3) Columns 8, 10, 12, and 14—the mutual fund return ratios. They state, in percents, how much each fund increases or decreases during the identified period.

The remaining columns are short-term returns—less than a year—or are interpretations of return and expense ratios.

Take a few minutes to locate the same information provided by your 401(k) provider. The individual mutual funds themselves also provide the information.

Ms. Tilson and *THE DATA* weren't much guidance. We were on our own, unless we were willing to pay an investment advisor. Lydia and I wanted to see what we could figure out before we started throwing our money at the problem. If at some point we decided to pay for help, we would be able to ask reasonably intelligent questions. With a little work we might be able to pick the funds and hold on to more of our money.

"Free Money"

Lydia and I liked having a retirement plan. Among the many benefits, our employer matched our contributions. It's like getting "free money." We also wanted our money invested in the best funds in our lineup. So, brainstorming during breaks and lunch seemed like a good idea.

Since we didn't have any better place to start, we decided to begin with Artisan Mid Cap. After some looking, we found the 8.7% ten-year return Ms. Tilson told us about. It was on row 20, column 14.

We wondered what an 8.7% ten-year return really meant and why she singled it out. As best we could tell, it didn't have the highest 10-year return on the list. Did she randomly pick Artisan to get us started thinking about investing? Or was it really the best choice in some way we didn't understand? I opened my computer and googled Artisan Mid Cap using its ticker, ARTMX.

Sidebar: The ticker identifies only one fund. Also, every fund's return, like ARTMX's 8.7%, will change over time.

Morningstar's website came up first. It is an investment news and business research service. What jumped out at us was the performance chart: "**Growth of 10K at ARTMX**" over the past ten years.

The chart showed $10,000 increasing to about $23,000 after a significant decline in 2008-2009. To us, ARTMX's chart looked pretty impressive if a little choppy. The blue line represented ARTMX's "growth." As best we could tell, mutual fund returns were included. We weren't sure what the green and orange lines meant.

The Morningstar webpage was crammed with so much information we were overwhelmed and didn't know where to go next.

Lydia looked as frustrated as I felt. Then she said what should have been obvious to me. "I wish I had a Grandmother like yours. Somebody who knows business and finance."

We had exchanged family histories over lunch at the company cafeteria. I have to admit, I bragged on Grandma Combs.

"Why didn't I think of that?!" I reached for my cell phone and began to dial her number.

"We shouldn't bother your Grandmother. I'm sure she's busy."

I set Lydia straight: “No problem. She’s a college professor. Has lots of time.”

I finally got through to Grandma and tried to explain our problem. She kept getting interrupted. It sounded like students asking questions. After a while, I got to the bottom line. “What do you think, Grandma? Is ARTMX a good investment?”

“What other funds are included in your plan?”

I started reading the names of funds listed in *THE DATA*. She stopped me at Vanguard 500 Index Fund, VFIAX. “That’ll do. I usually like mutual funds. But be careful. While a 10-year return of 8.7% is not to be ignored, it’s only one measure of performance. You’ve got some homework to do, sweetheart. Compare their returns *and* costs over a ten-year period. Make sure you include one significant market downturn. After you’re comfortable with what you’ve learned, give me a call.”

We were hoping Grandma would just tell us what we needed to do—which mutual funds to invest in—but I wasn’t surprised. She was going to make us do the work.

Lydia asked, “Which mutual fund do we start with?”

We didn’t have any reason to pick one fund over the other, so I pulled a coin from my pocket. “Heads, Artisan; tails, Vanguard.”

Up went the coin.

“Tails, Vanguard’s first.” I googled its ticker, VFIAX.

I read from my computer. “Investment Objective: The Fund seeks to track the performance of an index that measures the investment return.” I looked at Lydia and asked, “What’s an index?”

We backed up to get the term straight. I paraphrased a long and complicated internet definition. “An index fund is a type of mutual fund constructed to mimic a group of stocks like the S&P 500 or DOW. So, an S&P index fund tries to own the stocks in the S&P in the same proportion as they are found in the S&P.”[20]

We began to take notes. When I call for help again, Grandma would expect me to tell her where we got our information and how we reached our conclusions. And, as Lydia said, “We don’t want to look up every new term over and over again.”

I continued to summarize what I found: “VFIAX is an index fund that invests in the S&P 500. Its primary risk arises from the volatility experienced by the S&P 500.”[21]

We weren’t quite sure what all that meant but charged on.

Lydia asked, “Do we know what VFIAX invests in?”

“Sure. It says right here that ‘VFIAX’s recent month-end ten largest holdings were:

Apple Inc.
Microsoft Corp.
Alphabet Inc.
Exxon Mobile Corp
Johnson & Johnson
Berkshire Hathaway Inc.
Amazon.com Inc.
JPMorgan Chase & Co.
General Electric Co.
Facebook Inc.’ ”

Sidebar: The holdings change over time.

I recognized most of the companies.

Lydia did, too. **“**We buy their gasoline, software, computers, pharmaceuticals, internet services, appliances, credit cards, and lots of other stuff.”

“Okay, S&P 500 and VFIAX are beginning to make sense.”

Lydia said, “Let’s find VFIAX’s chart. I’d like to see its long-term history.”

As quickly as snapping my fingers, an internet search gave us VFIAX’s chart.

A typical chart, dollars were on the vertical axis and dates on the horizontal axis.[22] The best part was, Barchart.com was interactive. As we hovered the cursor over the graph, it identified dollar values. For example, “Apr 2017. Close 220.29.”

By studying VFIAX, we learned 220.29 is called net asset value per share, NAVPS, or NAV for short.

Sidebar: Bar Charts report NAVs for each month. NAVs are also reported daily on the New York Stock Exchange.

“So, if we owned a share of VFIAX and sold at the end of April 2017, we’d have gotten $220.29.”

“Yup. The chart gives us an historical perspective as well as current market value. It shows lots of ups and downs, just as I experienced with WorldCom.”

She had told me about her experience: the thrill of prices going up, followed by sharp declines, and soul searching regret when her company went out of business. Lydia had learned hard lessons.

“How do we know we’re not going to lose all of our money like you did with WorldCom?”

“The truth is, we can’t be 100% sure. The real question is, what are the odds that every company, or even most companies, owned by a mutual fund will fail at the same time. For example, take a look at VFIAX’s ten largest holdings, again. Can you imagine all of them going out of business? I think the odds of that happening are very small. In large part, that’s why 401(k) plans usually rely on mutual funds.[23] Still, mutual funds are going to have wild swings in value like we see in the VFIAX chart.”

With that bit of wisdom, Lydia went off to do family things, leaving me to ponder the “wild swings” of mutual funds.

What-If

While Lydia was preoccupied with family, I decided to play “what-if.” It was one of Grandma Combs’ favorite games. They’re like thought experiments. “What-if” might help me see potential problems portrayed by the ups and downs in the chart.

Two *what-ifs* seemed relevant. First, I asked myself, what if I *buy low and retire high* and see how good it could be. Second, what if I *buy high and retire low* and see how bad it could be.[24] I pulled up VFIAX's chart and identified highs and lows.

First, *buy low and retire high:* What if I had bought at the beginning of 2009 for $70 per share and retired January 12, 2017 when each share was worth approximately $210?

The gain per share would be:

$210 - $70 = $140

That seemed like a big increase per share, but the numbers seemed too small to really see what was going on. I made the game more interesting by "buying" 1000 shares.

Price x Quantity = Share Value (if purchased at the beginning of 2009)
$70 x 1000 = $70,000

Price x Quantity = Share Value (at January 12, 2017)
$210 x 1000 = $210,000

Share Value (January 12, 2017) – Share Value (beginning 2009) = Gain or Loss
$210,000 - $70,000 = $140,000 Gain

If I had bought VFIAX in 2009 and sold in 2017, I would have tripled my money and have a lot more for retirement.

The second case, what if I bought when VFIAX's price was high and retired when its price was low? Using real numbers from VFIAX's chart, I assumed I bought VFIAX at the beginning of 2001 at $126 per share and retired and sold the shares at the beginning of 2009 when its market value was $70.

Sales price per share (2001) – Sales price per share (2009) = Gain or Loss per share
$70 - $126 = -$56, loss per share.

I made it interesting by buying and selling 1000 shares.

Price x Quantity = Share Value (if purchased at the beginning of 2001)
$126 x 1000 = $126,000

Price x Quantity = Share Value (if sold at the beginning of 2009)
$70 x 1000 = $70,000

Share Value (beginning 2009) – Share Value (beginning 2001) = Gain or Loss
$70,000 - $126,000 = -$56,000, a loss

If I had invested in 2001 and sold in 2009, I would have lost almost half of my money, leaving me a lot less for retirement.

Sidebar: A mutual fund can, and typically does, experience significant changes in value over time. It's called volatility risk. Volatility, according to the dictionary, means "liable to change rapidly and unpredictably." We will discuss the technical meaning later.

Fast forward to January 2017. Now what do I do? VFIAX is valued at $210 per share! An all-time high. Is now a good time to buy VFIAX? Is its price going to continue to go up so that I can make money *buying low and selling high?* Or is its price so high that I'll lose money *buying high and selling low?*

Sidebar: Buy-low-and-sell-high is much easier said than done—even for professionals. The unfortunate truth is investors frequently do just the opposite, buy high and sell low. They hear good news about a stock or mutual fund and buy it too late when its price is high, or hear bad news about a stock or mutual fund they own and sell it too late. Both are recipes for financial disaster. If you sell low, you've locked in your losses. If you buy high, there may be very little upside left to gain.

Knowing when to buy and sell seemed to be key to profitable investment decisions. Maybe Grandma Combs will know how to deal with it. I added this issue to the questions I planned to ask her. All the same, I couldn't help but think there had to be a lot more to learn about the relation between VFIAX and the S&P 500.

S&P 500

VFIAX invests in the S&P 500. I got that. To know more about VFIAX, I had to look into the S&P 500. What exactly is it? I went online and did a search. "To be included in the S&P 500, a company must be a U.S. company with a market cap of at least $6.1 billion."[25]

Market cap? Every term seemed to raise another question. "Market capitalization (market cap) is the market value per share times the number of shares outstanding at a publicly traded company."[26] [27]

Sidebar: Coca-Cola is an S&P 500 company. Its recent stock price was $44.70 per share and its number of shares outstanding was approximately 4.26 billion. Coca-Cola's market cap, therefore, was approximately $190.4 billion.

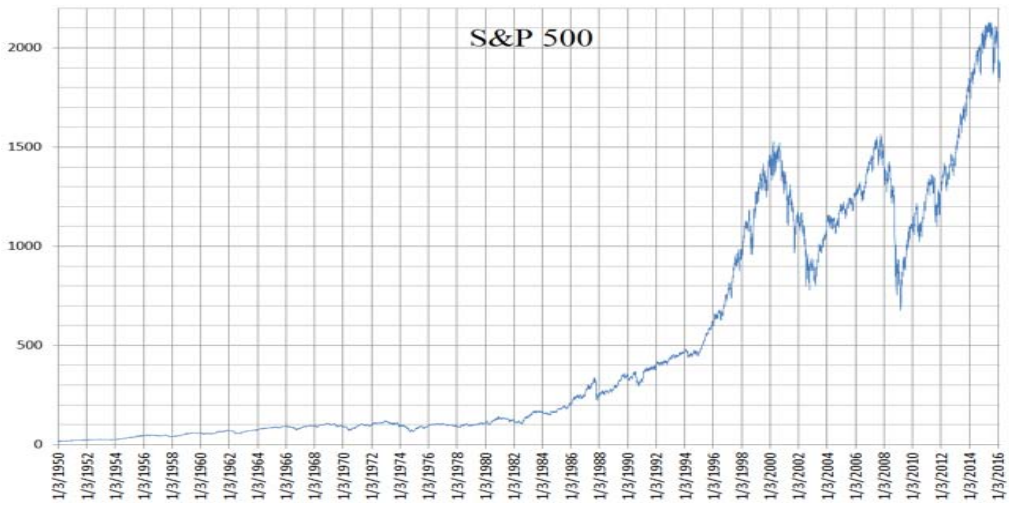
Price	x	Quantity	=	Market Cap
$44.70	x	4,260,000,000	=	$190,400,000,000

The companies listed on the S&P 500 index are very big in more ways than market cap. I clicked on 3M Company. “With $30 billion in annual sales, 3M employs 88,000 people worldwide and produces more than 55,000 products,
including: adhesives, abrasives, laminates, passive fire protection, dental and orthodontic products, electronic materials, medical products, and car-care products.” Many of the products were familiar. Even the Post-its™ on my desk is a 3M product.[28]

Next, I checked out the chart for S&P 500.[29] I clicked off the technical stuff, the “Log-Scale” and “Inflation-Adjusted.” I was just interested in seeing the trend over time that captured a significant downturn as Grandma recommended.

Sidebar: Analysts use Log-Scale to assess growth of stock values. They use Inflation-Adjusted to correct for changes in the long-term purchasing power of money. Both are modifications to absolute numbers. While economists and finance experts may need these adjustments, absolute numbers show the general trends we’re interested in. Adjustments for inflation are discussed in later chapters.

Something caught my eye. The idea was obscured by the length of time reported on the horizontal axis. The chart covered more than 60 years.



I clicked on “20 Years” so that I could have a better picture of the recent past.

Sidebar: Twenty to twenty five-years is long enough to see changes in a market. If the period is too short, you might miss significant market movements. If the period is too long, you might miss recent volatility.

I compared the S&P 500 chart with the VFIAX chart.

They looked a lot alike. Both showed big downturns in 2002-2003 and 2008-2009. Both showed a steep rise over the past decade. When I thought about it, the charts should look alike. The purpose of VFIAX is to invest in S&P 500 stocks and track their performance.

I also found two other stock exchanges: Dow Jones Industrial Average, **DJIA or DOW,** and the National Association of Securities Dealers Automated Quotations, **NASDAQ**.

The DOW lists the "nation's 30 top public companies."[30] As I studied the DOW, I recognized many companies that were also owned by VFAIX.

I had just about finished reading the list when Lydia returned. I had to ask, "How do you find time for work, children, and getting your 401(k) straight?"

"Time management," she smiled. Lydia proved it by getting right down to business. She noticed I was looking at the list of DOW companies and said, "Since I'm using a Mac, let's check Apple, Inc., APPL."

I clicked on "APPL" and found Apple's most recent stock price, the latest news and press releases, and much more. A news report said smart phones could stream stock market

quotes and charts for individual companies and mutual funds. We ran a test to see how it worked. We set our phones to follow our current mutual fund of interest, VFIAX. Like magic, its market price per share and its chart appeared on our small screens.

"Once I pick funds for my 401(k), I plan to post them on my smart phone so I could easily access the most recent share values and news."

"It would have been much easier to monitor WorldCom, if I had a smart phone. And, if I'd had the inclination to actually use it."

Since the companies listed on the DOW were among VFIAX's holdings, it seemed reasonable the DOW and VFIAX charts would have similar ups and downs. To confirm that, we clicked on the "Dow Jones – 100 Year Historical Chart."[31]

Although the chart covered 100 years, we again selected the 20-year range and clicked off Log Scale and Inflation-Adjusted.

The DOW showed the same drops during 2002-2003 and 2008-2009 that we saw for VFIAX and S&P 500. Another feature of all three charts was obvious: the upward path of the market since 2009.

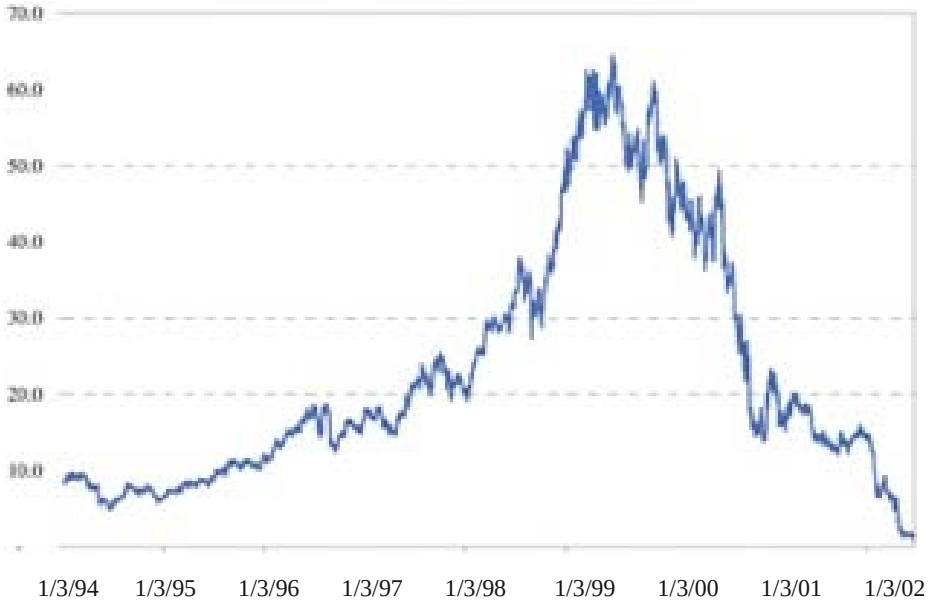
As I studied the DOW chart, Lydia had moved on. “While we’re at it, we might as well check out NASDAQ.”

We found a list of companies traded on NASDAQ, the “tech stock index.” It generally reported smaller companies than those on the DOW.[32]

To get an idea of the companies listed on NASDAQ, we clicked on FLOWERS.COM Inc., FLWS, and were taken to a website describing its business products, current stock price, market capitalization, and much more. FLOWERS.COM markets flowers and gifts. It has a web-presence that facilitates operations between suppliers and customers worldwide. Similar information for other NASDAQ stocks was easy to get.

A visit to NASDAQ’s chart was next.[33]

It had a peak at the turn of the century. Lydia called it “The Tech Bubble.” She pulled up WorldCom’s chart.



It showed a peak at about the same time as the “The Tech Bubble.” WorldCom’s price drop ended in bankruptcy. Other companies trading on NASDAQ appeared to have recovered quite nicely.

One thing seemed clear: NASDAQ, S&P 500, DOW, and VFIAX all showed similar declines in 2002-2003 and 2008-2009 along with a steep increase over the past decade.

We couldn’t help but wonder what was causing the charts to appear similar. It certainly looked like something was going on that we didn’t understand.

“Time to call Grandma Combs.” It took a few minutes to tell her what we’d found. She waited patiently for us to get to our questions.

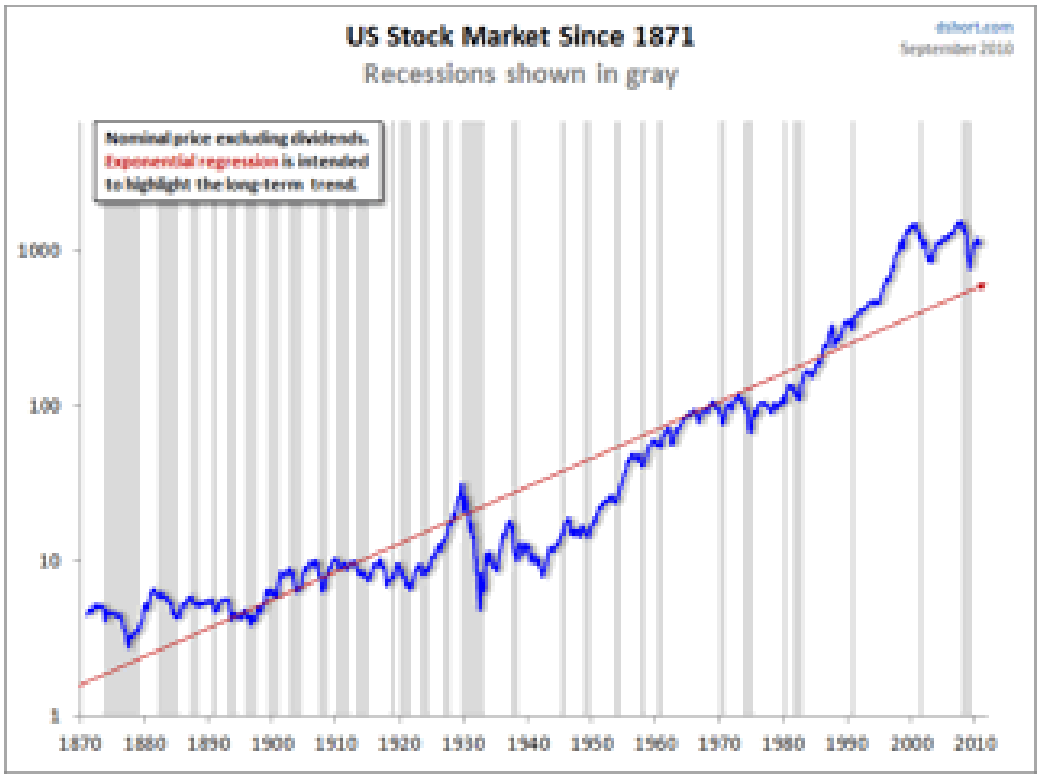
“Why all the ups and downs? Why is every chart moving in a similar direction at about the same time? Is it related to our aim to buy low and sell high?”

“Let me give you a simple answer. Buying low and selling high is a goal, often plagued with uncertainty of market movements. An economist might sneer at my explanation as oversimplification, but for our purposes the ups and downs—the volatility—you see in the charts are pictures of the overall economy. Very hard to predict before it occurs, like buying low and selling high. Market downturns are easiest to understand. When people buy fewer goods and services, businesses produce less. When businesses produce less, they need fewer workers, so they lay off employees. Fewer people with money to buy goods and services leads to reduced demand and more layoffs. Economists call it a downward spiral, which may become a recession, which is very hard to predict in advance. And, if the downward cycle lasts long enough, the economy may slip into a depression, a serious contraction of production and consumption. The opposite—a boom economy—can occur when money is cheap, governments increase spending on things like infrastructure, and businesses anticipate increasing demand and ramp up production. Employment increases. Consumers buy more goods and services and the economy expands.

“Of course, financial analysts—sometimes called market timers—use these market conditions to try to predict when to buy and sell. Their goal is buy low and sell high. Rarely are they successful—never consistently successful.

“I’m sending an email with links to two websites. First is an analysis of business cycles from the National Bureau of Economic Research.[34] The second is a chart of recessions over the past hundred years that will give perspective of what you’ve already discovered. Take a minute to pull up the chart on your computer…”[35]

“Okay …. We’re looking at the ‘US Stock Market Since 1871.”



Grandma was in full teacher mode as she asked, “What do you see?”

“If the vertical grey lines represent recessions, the chart shows they occur periodically.”

“When you located downturns for VFIAX, S&P, DOW, and NASDAQ during 2002-2003 and 2008-2009, you identified the most recent recessions. Also notice that there’s no consistent, predictable amount of time between recessions. Our economy has recovered from them and each time the stock market has gone higher.”

“Grandma, will the market always recover and keep going up?”

There was a long pause. It was obvious Grandma was thinking about her response.

“Historically, that’s what’s happened. It’s tempting to interpret the charts as evidence that recessions will recover and markets will continue to go up. Similarly, it’s tempting to interpret the charts as a means of identifying when to buy low and sell high. But they

don't provide that evidence. They report what has happened in the past, not what *will* happen. We can't accurately predict the economy, market volatility, the exact date of recessions, or the market highs and lows. Nevertheless, we can pay attention to past and current returns and costs of the individual funds in our retirement accounts and make our best investment choices.

"Let me offer a couple more recommendations. The data you got from NBIS includes return and expense ratios. I suspect you noticed that when you looked up a mutual fund on the internet, you found the ratios. They're important. That's why providers like NBIS are required to report them. And mutual funds like VFIAX report them, too. Use both return and cost ratios to evaluate your investment choices.

"Volatility is more difficult to measure. Figure out how to factor it into your decisions. Lastly, have you compared VFIAX and ARTMX?"

"No ma'am."

"Let me know what you learn."

Practical Finance

Grandma helped us understand the volatility we saw in the charts. I just wish she'd give us answers to questions like, which mutual funds should we purchase? She believes we should learn as much as we can on our own. I've heard her say, "You'll remember it better that way."

Sidebar: You might agree with Aaron's wish: *Why don't **we** just tell you which mutual fund(s) to pick?* The short answer is, it won't work. First, not every 401(k) plan includes the same lineup. Second, nothing stays the same. The lineup for every 401(k) should be reviewed periodically—at least once a year—to make sure the funds are consistent with the plan's investment statement and compliant with Department of Labor Standards. Third, even if everyone started with the same lineup, business conditions change, returns

change, costs change, and each of you have a different tolerance for risk, which also changes over time. (We'll discuss risk in greater detail, later.) Fourth, you'll probably change jobs and move your assets into another 401(k), which will have a different lineup of mutual funds.

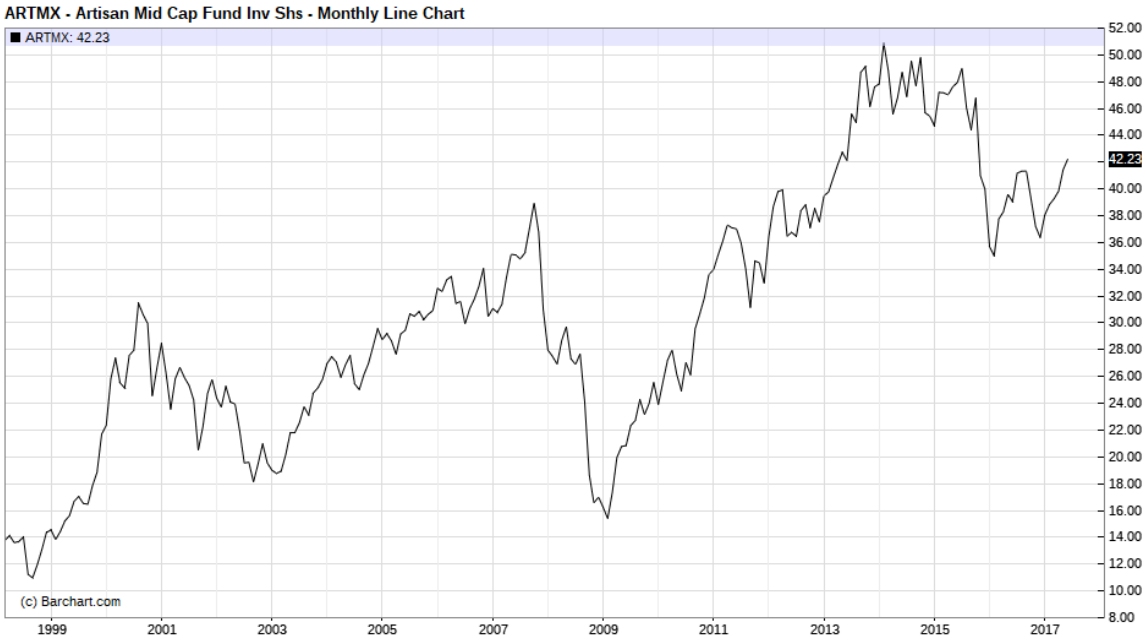
You need to know how to make the investments. We'll show you how. You'll be able to retrace our steps, which will accommodate your lineup of mutual funds, even as the lineup and your circumstances change over time.

"I'm sure Grandma will help us again when we get stuck."

Lydia was also grateful for Grandma's help, but I detected frustration in her voice: "I took a finance course in college, but they didn't teach us any of this stuff!"

ARTMX and VFIAX

Grandma suggested a comparison of ARTMX and VFIAX. We had studied VFIAX's chart but not ARTMX's. We pulled both up and looked at them side-by-side.



Although ARTMX's chart began in 1999 and VFIAX's in 2001, we could see general trends, including troughs and peaks occurring at about the same time. Troughs are market lows and peaks are highs. (We were picking up terminology and starting to use it.) Unfortunately, we couldn't look at the charts and see whether ARTMX or VFIAX had higher returns or lower costs; or whether one was more volatile than the other; or whether one was a better investment than the other. We needed ways to compare mutual funds and pick the best. Grandma clearly thought understanding returns, costs, and volatility was the place to start.

There was no reason to invest if we didn't expect to make money, but how much should we expect make and how do we calculate it? Questions came easier than answers, but they were a start.

Little, Itty-Bitty Numbers

We didn't know how 401(k)s really worked. We knew our employer matched our contributions. We knew there were costs, but who knew how much or who paid them? We certainly didn't know!

Grandma was right. Every time we looked up VFIAX or ARTMX, we found the ratios. The problem was they were not in a form we understood.

CHAPTER 3

How do I pick mutual funds?

Return and Cost Ratios

Grandma Combs encouraged us to get a handle on returns and costs. So, we went back to the *THE DATA.*

Sidebar: In one form or another—one page in small print, like *THE DATA*, or a dozen pages in larger print—your lineup of mutual funds and their return and expense ratios are provided to all 401(k) participants.

Mutual Fund Performance Data (*THE DATA*)

		Exp Ratio	Total Return 3 Mo USD	Tot Ret %tile 3 Mos	YTD	YTD %tile	Total Rtn Annlzd 1 Yr	Tot Ret %tile 1 Yr	Total Rtn Annlzd 3 Yr	Tot Ret %tile 3 Yr	Total Rtn Annlzd 5 Yr	Tot Ret %tile 5 Yr	Total Rtn Annlzd 10 Yr	Tot Ret %tile 10 Yr
Vanguard Target Retirement Income Inv	VTINX	0.14	-0.99	65	5.25	40	5.25	40	3.50	10	4.91	31	4.88	9
Vanguard Target Retirement 2015 Inv	VTXVX	0.14	-0.55	76	6.16	57	6.16	57	4.04	15	7.22	32	4.85	3
Vanguard Target Retirement 2020 Inv	VTWNX	0.14	-0.18	50	6.95	28	6.95	28	4.39	3	8.17	12	4.99	3
Vanguard Target Retirement 2025 Inv	VTTVX	0.15	0.11	48	7.48	26	7.48	26	4.53	4	8.86	22	5.00	7
Vanguard Target Retirement 2030 Inv	VTHRX	0.15	0.42	50	7.85	32	7.85	32	4.58	8	9.50	20	4.98	12
Vanguard Target Retirement 2035 Inv	VTTHX	0.15	0.78	54	8.26	34	8.26	34	4.66	11	10.15	18	5.09	9
Vanguard Target Retirement 2040 Inv	VFORX	0.16	1.13	48	8.73	26	8.73	26	4.66	19	10.51	16	5.26	8
Vanguard Target Retirement 2045 Inv	VTIVX	0.16	1.24	49	8.87	28	8.87	28	4.72	15	10.54	20	5.27	10
Vanguard Target Retirement 2050 Inv	VFIFX	0.16	1.25	47	8.85	31	8.85	31	4.72	23	10.54	18	5.27	8
Vanguard Target Retirement 2055 Inv	VFFVX	0.16	1.26	48	8.88	29	8.88	29	4.68	18	10.51	30		
Vanguard Target Retirement 2060 Inv	VTTSX	0.16	1.25	58	8.84	21	8.84	21	4.67	1				
Dodge & Cox Balanced Fund	DODBX	0.53	6.80	2	16.56	3	16.56	3	7.22	3	13.36	1	6.01	19
Dodge & Cox Income	DODIX	0.43	-1.24	3	5.61	7	5.61	7	3.46	17	3.77	11	5.05	16
Vanguard Total Bond Index	VBTLX	0.06	-3.17	90	2.60	63	2.60	63	2.94	41	2.14	71	4.29	52
MFS Value R5	MEIKX	0.51	4.51	77	14.25	51	14.25	51	7.98	24	14.82	12	6.91	16
Vanguard 500 Index Fund	VFIAX	0.05	3.82	44	11.93	27	11.93	27	8.84	6	14.62	16	6.94	23
Harbor Capital Appreciation	HACAX	0.65	-1.94	77	-1.07	84	-1.07	84	6.48	41	13.96	31	8.01	20
Victory Sycamore Established Value	VEVRX	0.63	5.34	72	21.11	25	21.11	25	11.15	3	15.57	16	9.83	3
Vanguard Mid Cap Index	VIMAX	0.08	2.14	90	11.22	73	11.22	73	7.67	34	14.37	39	7.66	39
Artisan Mid Cap	ARTMX	1.19	-4.15	96	-0.89	94	-0.89	94	2.29	79	11.94	47	8.70	16
Diamond Hill Small Cap - CLOSED	DHSIX	1.01	7.90	94	14.45	97	14.45	97	5.03	77	12.93	79	6.96	52
Vanguard Small Cap Index	VSMAX	0.08	6.10	93	18.30	70	18.30	70	7.01	41	14.83	35	8.18	20
AMG Managers LMCG Small Cap Growth	ACWDX	1.36	2.44	59	-5.42	99	-5.42	99	0.23	86	12.21	53		
TIAA-CREF International Eq Idx Instl	TCIEX	0.06	-1.47	32	1.22	42	1.22	42	-1.63	41	6.69	28	0.85	35
American Funds EuroPacific Gr R6	RERGX	0.50	-4.15	25	1.01	21	1.01	21	-0.60	21	7.22	26	2.89	12
Virtus Emerging Markets Opportunities R6	VREMX	1.18	-11.19	97	1.59	88	1.59	88	-0.61	10	1.97	43	4.24	2
T. Rowe Price Real Estate	TRREX	0.76	-1.85	20	6.03	51	6.03	51	12.96	25	11.74	20	4.69	40
Hotchkis & Wiley High Yield	HWHAX	0.95	2.17	24	15.69	19	15.69	19	3.65	42	7.28	16		
Deutsche Enhanced Commodity Strat Inst	SKIRX	0.99	2.26	58	10.98	68	10.98	68	-4.76	7	-4.54	2	-2.10	5
BlackRock Inflation Protected Bond Instl	BPRIX	0.35	-2.35	58	4.11	55	4.11	55	1.51	45	0.55	40	4.27	9

		Exp Ratio	TotalReturn 3 Mo USD	YTD	Total Rtn Annlzed 1 Yr	Total Rtn Annlzed 3 Yr
Goldman Sachs Stable Value	GSSV1	0.25	0.32	1.25	1.25	1.12

Lydia said, “Let’s see if we can make sense of these numbers.”

We located ARTMX's 8.7 ten-year return. Its expense ratio was 1.19. We also found VFIAX's. Its ten-year return was 6.94 and its expense ratio was .05.

My lack of knowledge showed very quickly. I thought .05 was 5%.

Lydia gently corrected me. "Ratios are stated in percentages. The percent symbol is left off. That convention is not stated anywhere in *THE DATA*. It's simply understood."

"Well, I didn't understand it!"

Lydia laughed and said, "So, VFIAX's .05 expense ratio is really .05%. Its 6.94 return ratio is 6.94%."

I would have stumbled badly if Lydia hadn't explained, "We have to be able to convert percents to decimals and decimals to percents if we're going to work with return and cost ratios. For example, .05% in decimal form is .0005. We simply move the decimal two places to the left and drop the % symbol. Working the other way, if we begin with the decimal, .0005, and need to convert it to a percent, move the decimal point two places to the right and attach the % symbol, .05%. Likewise, ARTMX's 8.7% ten-year return converted to a decimal is .087. Its expense ratio is 1.19%. In decimal form, it is .0119."

Sidebar: The translation from percent to decimal and vice versa is a definition. No deep financial meaning here.

None of the expense ratios looked very big. In fact, the biggest one on the list was .0136, or 1.36%. It belonged to AMG Managers LMCG, whose ticker was ACWDX.

I shook my head. "VFIAX's expense ratio, .0005, is nothing! ARTMX's expense ratio, .0119, isn't much bigger. My credit card charges 15%, or .15. Mutual funds seem really cheap by comparison. What you've heard about mutual funds being expensive seems wrong. And, if they're as cheap as they seem to be, how will expense ratios help us

choose among them? Same problem with return ratios. VFIAX's ten-year return ratio is .0694, while ARTMX's is only slightly better at .087."

"Wait a second," Lydia said. "Numbers can get complicated in a hurry. Let's organize them a bit." She pulled a note pad from her briefcase and wrote out the following:

	ARTMX	VFIAX
Return Ratio	.0870	.0694
Expense Ratio	.0119	.0005

"Returns are what we get from investments. ARTMX's return ratio is .0870, which is larger than VFIAX's at .0694. Costs reduce our total returns. ARTMX's expense ratio is .0119, which is larger than VFIAX's at .0005. Now, think about it for a minute. Is ARTMX a better investment because it had a higher 10-year return ratio than VFIAX? Or is VFIAX a better investment because it had a lower expense ratio than ARTMX? See what I mean?"

"Noooo, not really."

"Okay. Instead of trying to understand what's going on in terms of these itty-bitty numbers, let's think in dollars, an idea we're more familiar with."

"I like that."

"Assume Company A has revenues of $100 million and expenses of $80 million while Company B has revenues of $110 million and expenses of $100 million. Which is more profitable? Is Company B more profitable because it has more revenue? Or is Company A more profitable because it has lower expenses?"

Lydia wrote out the example so that I could see what she was saying.

	Company A	Company B
Revenue	$100M	$110M
Expenses	80M	$100M
Profit	$20M	$10M

Once Lydia wrote the example in dollars, the answer was obvious. “Company A is more profitable even though it has less revenues than Company B. Company B’s expenses offset any advantage it has in revenues.”

“Now, if Company A has revenues of $100 million and expenses of $70 million, while Company B has revenues of $120 million and expenses of $80 million, which is more profitable?”

	Company A	Company B
Revenue	$100M	$120M
Expenses	$70M	$80M
Profit	$30M	$40M

“Company B.”

“Right. Company B is more profitable even though it has higher expenses than Company A. Company A’s revenues are not large enough to provide an advantage for its lower expenses.”

“I get it now. We can’t assume a mutual fund is a better investment because it has a higher return ratio or a lower expense ratio. The way you’ve spelled it out, the answer is easy to see. But when I look at the ratios from *THE DATA*, I can’t tell which of the funds are better. How do we use ratios to compare our mutual funds?”

Dollars!

I was at a loss where to start, but Lydia wasn’t. And she got directly to it.

“We understand dollars?”

“Right.”

“When we compared Company A’s revenues and expenses in dollars with Company B’s, we could see which was more profitable.”

“Right, again.”

“So, let’s translate mutual fund return and expense ratios into dollars and see which might make more money for us.”

“Great! But how?”

“Let’s start with something familiar. Earnings on a bank deposit are similar to earnings on a 401(k). We use an interest rate to calculate earnings on savings. I’ll use return and expense ratios to measure earnings on a 401(k). See what I mean?”

“I think so, maybe.” I didn’t sound convinced. Truth was, I only had a vague notion where Lydia was going, but she was smart, so I listened.

“I’m working it out in my own mind so I’ll take it a step at a time. Details—it’s always the way to go.” She pointed at the top line of *THE DATA*. “Columns 8, 10, 12, and 14 are listed as ‘total returns annualized.’ We’ve been calling them return ratios. We’re also interested in column 3, expense ratios. Column 2, the tickers, identifies the mutual funds.”

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Exp Ratio	Total Return 3 Mo USD	Tot Ret %tile 3 Mos	YTD	YTD %tile	Total Rtn Annlzd 1 Yr	Tot Ret %tile 1 Yr	Total Rtn Annlzd 3 Yr	Tot Ret %tile 3 Yr	Total Rtn Annlzd 5 Yr	Tot Ret %tile 5 Yr	Total Rtn Annlzd 10 Yr	Tot Ret %tile 10 Yr
Vanguard Target Retirement Income Inv	VTINX	0.14	-0.99	65	5.25	40	5.25	40	3.50	10	4.91	31	4.88	9
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Vanguard Target Retirement 2020 Inv	VTWNX	0.14	-0.18	50	6.95	28	6.95	28	4.39	3	8.17	12	4.99	3
Vanguard Target Retirement 2025 Inv	VTTVX	0.15	0.11	48	7.48	26	7.48	26	4.53	4	8.86	22	5.00	7
Vanguard Target Retirement 2030 Inv	VTHRX	0.15	0.42	50	7.85	32	7.85	32	4.58	8	9.50	20	4.98	12
Vanguard Target Retirement 2035 Inv	VTTHX	0.15	0.78	54	8.26	34	8.26	34	4.66	11	10.15	18	5.09	9
Vanguard Target Retirement 2040 Inv	VFORX	0.16	1.13	48	8.73	26	8.73	26	4.66	19	10.51	16	5.26	8
Vanguard Target Retirement 2045 Inv	VTIVX	0.16	1.24	49	8.87	28	8.87	28	4.72	15	10.54	20	5.27	10
Vanguard Target Retirement 2050 Inv	VFIFX	0.16	1.25	47	8.85	31	8.85	31	4.72	23	10.54	18	5.27	8
Vanguard Target Retirement 2055 Inv	VFFVX	0.16	1.26	48	8.88	29	8.88	29	4.68	18	10.51	30		
Vanguard Target Retirement 2060 Inv	VTTSX	0.16	1.25	58	8.84	21	8.84	21	4.67	1				
Dodge & Cox Balanced Fund	DODBX	0.53	6.80	2	16.56	3	16.56	3	7.22	3	13.36	1	6.01	19
Dodge & Cox Income	DODIX	0.43	-1.24	3	5.61	7	5.61	7	3.46	17	3.77	11	5.05	16
Vanguard Total Bond Index	VBTLX	0.06	-3.17	90	2.60	63	2.60	63	2.94	41	2.14	71	4.29	52
MFS Value R5	MEIKX	0.51	4.51	77	14.25	51	14.25	51	7.98	24	14.82	12	6.91	16
Vanguard 500 Index Fund	VFIAX	0.05	3.82	44	11.93	27	11.93	27	8.84	6	14.62	16	6.94	23
Harbor Capital Appreciation	HACAX	0.65	-1.94	77	-1.07	84	-1.07	84	6.48	41	13.96	31	8.01	20
Victory Sycamore Established Value	VEVRX	0.63	5.34	72	21.11	25	21.11	25	11.15	3	15.57	16	9.83	3
Vanguard Mid Cap Index	VIMAX	0.08	2.14	90	11.22	73	11.22	73	7.67	34	14.37	39	7.66	39
Artisan Mid Cap	ARTMX	1.19	-4.15	96	-0.89	94	-0.89	94	2.29	79	11.94	47	8.70	16
Diamond Hill Small Cap - CLOSED	DHSIX	1.01	7.90	94	14.45	97	14.45	97	5.03	77	12.93	79	6.96	52
Vanguard Small Cap Index	VSMAX	0.08	6.10	93	18.30	70	18.30	70	7.01	41	14.83	35	8.18	20
AMG Managers LMCG Small Cap Growth	ACWDX	1.36	2.44	59	-5.42	99	-5.42	99	0.23	86	12.21	53		
TIAA-CREF International Eq Idx Instl	TCIEX	0.06	-1.47	32	1.22	42	1.22	42	-1.63	41	6.69	28	0.85	35
American Funds EuroPacific Gr R6	RERGX	0.50	-4.15	25	1.01	21	1.01	21	-0.60	21	7.22	26	2.89	12
Virtus Emerging Markets Opportunities R6	VREMX	1.18	-11.19	97	1.59	88	1.59	88	-0.61	10	1.97	43	4.24	2
T. Rowe Price Real Estate	TRREX	0.76	-1.85	20	6.03	51	6.03	51	12.96	25	11.74	20	4.69	40
Hotchkis & Wiley High Yield	HWHAX	0.95	2.17	24	15.69	19	15.69	19	3.65	42	7.28	16		
Deutsche Enhanced Commodity Strat Inst	SKIRX	0.99	2.26	58	10.98	68	10.98	68	-4.76	7	-4.54	2	-2.10	5
BlackRock Inflation Protected Bond Instl	BPRIX	0.35	-2.35	58	4.11	55	4.11	55	1.51	45	0.55	40	4.27	9

		Exp Ratio	TotalReturn 3 Mo USD	YTD	Total Rtn Annlzed 1 Yr	Total Rtn Annlzed 3 Yr
Goldman Sachs Stable Value	GSSV1	0.25	0.32	1.25	1.25	1.12

"When I squint my eyes, I can read them."

"Okay, time to do a little housekeeping." Lydia copied columns 2, 3, 8, 10, 12, and 14 and pasted them in an Excel spreadsheet. She saved the relevant data as RD1. (Click on the spreadsheet icon.)

RD1.xlsx

The tickers went in column A, the return ratios in columns B through E, and the expense ratio in column F. (For convenience, the spreadsheet is copied below.)

A	B	C	D	E	F
TICKER	Yr 1	Yr 3	Yr 5	Yr 10	Expense Ratios
ARTMX	-0.0089	0.0229	0.1194	0.087	0.0119
VFIAX	0.1193	0.0884	0.1462	0.0694	0.0005
DODBX	0.1656	0.0722	0.1336	0.0601	0.0053
DODIX	0.0561	0.0346	0.0377	0.0505	0.0043
VBTLX	0.026	0.0294	0.0214	0.0429	0.0006
MEIKX	0.1425	0.0798	0.1482	0.0691	0.0051
HACAX	0.0107	0.0648	0.1396	0.0801	0.0065
VEVRX	0.2111	0.1115	0.1557	0.0983	0.0063
VIMAX	0.1122	0.0767	0.1437	0.0766	0.0008
DHSIX	0.1445	0.0503	0.1293	0.0696	0.101
VSMAX	0.183	0.0701	0.1483	0.0818	0.0008
ACWDX	-0.0542	0.0023	0.1221		0.0136
TCIEX	0.0122	-0.0163	0.0669	0.0085	0.0006
RERGX	0.0101	-0.006	0.0722	0.0289	0.005
VREMX	0.0159	-0.0061	0.0197	0.0424	0.0118
TRREX	0.0603	0.1296	0.1174	0.0469	0.0076
HWHAX	0.1569	0.0365	0.0728	0.1058	0.0095
SKIRX	0.1098	-0.0476	-0.0454	-0.021	0.0099
BPRIX	0.0411	0.0151	0.0055	0.0427	0.0035
VFIFX	0.0885	0.0472	0.1054	0.0527	0.0016

“See the numbers better, now?”

“Much better. Why didn’t I think of that?”

We laughed because the answer was obvious. I had no idea what I was doing.

Ratios Are Like Interest Rates

"Think of return ratios as being similar to interest rates on bank savings accounts. There are four return ratios instead of one interest rate. We'll deal with that issue in a second. Here's how bank savings work. You deposit money expecting to get it back plus interest. How much you get back is determined by the interest rate your bank pays and how much you deposit. Now let's compare that with how 401(k) contributions work. Our employer and we make contributions to our 401(k) accounts similar to deposits. We expect we'll get back the full amount of our contributions plus earnings. How much we get back is determined by the return and cost ratios and the amount of contributions."

"How about an example? I want to be sure I'm following you."

"We can do that. An easy one first. Assume you deposit $10,000 in a savings account that earns 3% interest per year. You plan to leave the money there for at least a couple of years.

"In the first year, you earn a *return* of $300. In the second year, you start with the original deposit plus the interest earned, or $10,300. The interest you earn and leave in the bank is called compound interest. It is added to the principal to become the new investment amount—$10,300—at the beginning of the second year. At the end of the second year, you will have earned 3% interest on $10,300, or $309, for a total of $10,609."

"I think I understand. In the second year, I'm earning interest on the interest. In a few years, compound interest can really add up."

"That's why it's called the power of compounding."

"You know I'm not crazy about math. Is there an easy way to do the calculations?"

"Sure. I bet the internet has an easy-to-use calculator."

“What do I google? Specifically?”

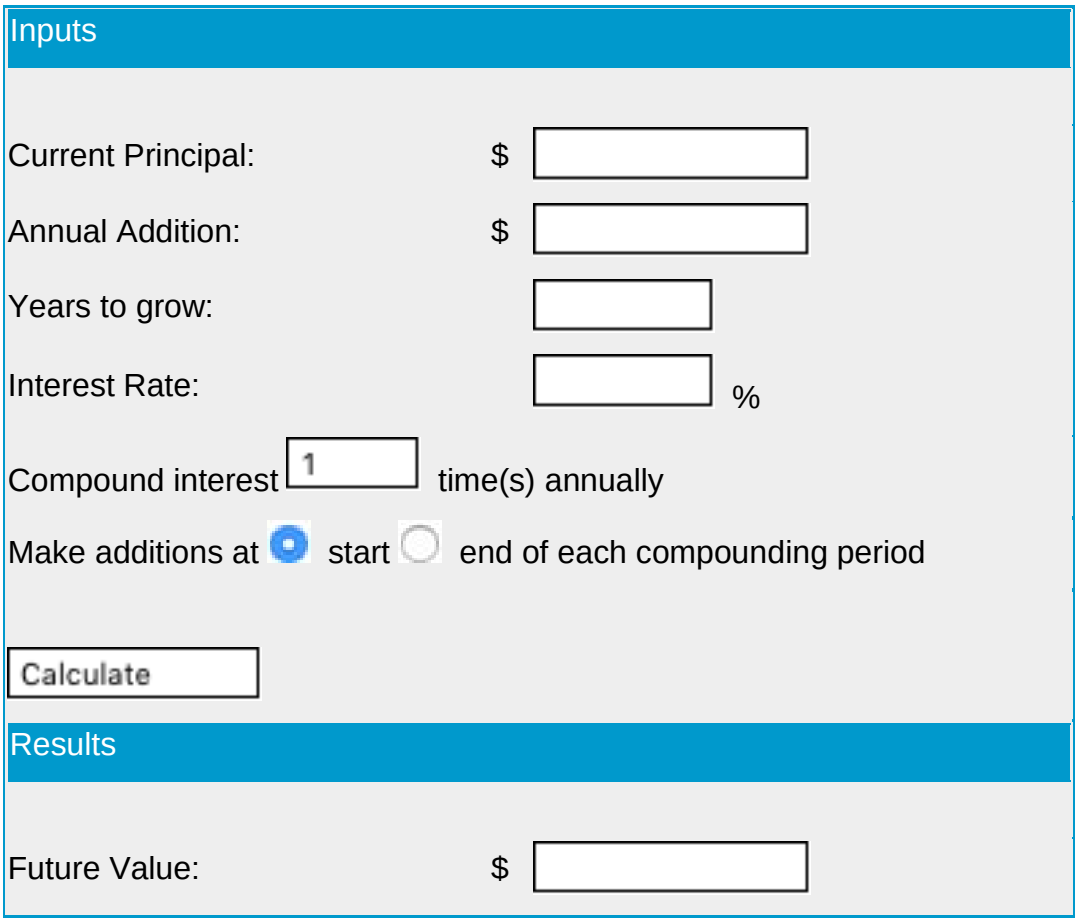
“Well, we are calculating compound interest, so try ‘compound interest calculator’.”

I quickly found MoneyChimp. “Let’s try it.” http://www.moneychimp.com/calculator/compound_interest_calculator.htm

“You do it. I’m going to do the calculation using a future value formula. We’ll see if MoneyChimp and the future value formula give the same result.”

“Deal.” I began filling in the blanks.

Compound Interest Calculator



I typed *$10,000* in the blank for "Current Principal." I ignored "Annual Addition" because we making one deposit at the beginning of a period and are not making annual additions. I typed *2* in "Years to grow," *3* in "Interest Rate," and *1* in "Compound interest __ time(s) annually." Lastly, I clicked on "Calculate."

MATH ALERTS are a look inside the black boxes calculators. They can be skipped. Lydia used a formula to calculate the future value of $10,000 earning 3% interest compounded annually. The formula is sometimes called the future value formula. MoneyChimp and the formula should produce the same result, because MoneyChimp is programmed with the future value formula. MoneyChimp is a black box calculator, and the future value formula offers a look in side the black box.

Year 1: $10,000 x 1.03 = $10,300
Year 2: $10,300 x 1.03 = $10,609

Or the calculation can be done in one step:

$10,000 x $(1 + .03)^2$ = $10,609.

This is the same as:

$10,000 x (1 + .03) x (1 + .03) = $10,609.

Notice that raising to a power is simply repeated multiplication: $(1 + .03)^2$ = (1 + .03) x (1 + .03).

In general, a short cut to calculate compound interest uses the following formula:

Investment x $(1 + r)^n$.

r is the rate of interest and n is the number of periods.

The power of compounding and the efficiency of using the future value formula or MoneyChimp is made clear by looking at a slightly more complicated example. Assume we save $25,000 for 30 years earning 5.5% per year.

$25,000 x $(1 + .055)^{30}$ = $124,599. The investment almost quintuples! Furthermore, the formula is a significant shortcut.

Or you can use MoneyChimp's Compound Interest Calculator. It produces the same answer: $124,598.78, which we rounded off to $124,599.

I looked over at Lydia's calculations. "We have a match! $10,609." I felt pretty good. MoneyChimp allowed me to do the math on my own.

"In plain English," Lydia said, "what you've done is calculate the future value of $10,000 earning 3% interest compounded annually in one step using MoneyChimp.

"We'll be doing similar calculations with our investments in mutual funds. We'll make contributions to our 401(k)—like deposits in a bank—and leave them there to "grow" over time—just as we did with our bank deposit. We'll use mutual fund ratios much as we used interest rates for bank deposits. The time frame may be longer for our retirement accounts. However, the way we use MoneyChimp or the future value formulas will be basically the same."

Capital Appreciation

Lydia made it sound so easy but I couldn't help wonder aloud, "Are mutual fund earnings as simple as interest on bank deposits?"

Lydia offered, “Mutual funds *seem* more complicated. Bank deposits initially pay one interest rate for a specific period of time. Simple. Mutual funds, on the other hand, invest in stocks that *may* earn dividends and capital appreciation. When we invest in funds, we earn them indirectly. Mutual funds that invest in bonds or other debt instruments may earn interest—like bank deposits—and capital appreciation. We would earn them indirectly through a mutual fund. Some funds invest in both stocks and bonds, so they might earn dividends, interest, and capital appreciation.”

“Capital appreciation?”

“I learned about capital appreciation and its opposite, declines in a stock’s capital value, when I worked at WorldCom. Capital appreciation happens when a stock’s price increases. If you buy a share of Coca Cola for $42 and next month it is selling for $45, you’ll have capital appreciation of $3. If that share of Coca Cola drops from $42 to $37, there is a $5 decline in capital value.

Sidebar: Companies’ stock prices constantly change because of demand for their products, competence of its management, expected increases or decreases in earnings, or any number of events. Since an equity fund owns many stocks, when stock values change, the fund returns change, too.

Similarly, a company’s or government’s bond prices change all the time because the borrower’s creditworthiness changes, the supply and demand for money changes, interest rates change, or any number of events. Since a bond fund is made up of many bonds, when their values change, the fund return’s change, too.

For an introduction to the supply and demand for money and changes in interest rates, see, https://www.forbes.com/sites/davidmarotta/2014/03/30/how-does-the-fed-control-interest-rates-in-a-free-market/#6bbc77a17852.

For an introduction to how an individual's creditworthiness is determined, see, https://www.investopedia.com/terms/c/credit-worthiness.asp.

"If things work the way they're supposed to—knock on wood—our fund investments will earn dividends, interest, and capital appreciation. The market and our investments should have more increases than decreases. As with savings accounts, fund earnings should accumulate and earn returns. That means we can use MoneyChimp to estimate future returns."

"I followed your bank deposit example, but I still need help with mutual funds."

"Here's the heart of the matter." Lydia pointed at the list of tickers in RD1 and said, "This is our lineup of mutual funds. We choose from among them. We'll be investing dollars expecting to earn a return. That's very much like depositing money in a savings account. However, every one of the funds reports returns for years 1, 3, 5, and 10, not a single interest rate like our bank deposit. Before we use MoneyChimp or a future value formula, we'll average the 1, 3, 5, and 10-year return ratios for each fund giving us a ***gross*** return ratio.

Sidebar: Averaging the return ratios of each mutual fund provides a common basis for comparisons, and reflects idiosyncratic ups and downs unique to each individual mutual fund.

"We'll subtract each fund's expense ratio from its average gross return ratio, producing an average ***net*** return ratio. At that point, it's very much like a bank deposit.

"Once we have the net return ratio, we'll use it with our contributions to calculate expected net return in *dollars*."

"You'll show me?" I said hopefully.

Lydia nodded. “Yes. But we don’t want to lose sight of our goal. We want to compare funds in dollars. We want to choose the best. So, our what-if will be like an experiment. We’ll put the same amount of money in each mutual fund and then observe which has the best net returns in dollars.”

“Let’s make it real. Use my retirement information.”

“Okay. Your information will make our results more meaningful. What are your expected contributions per year?”

“I’m signed up to contribute $1,140 which is 3% of my salary. Our employer will match that.”

“So, you’re making contributions of $2,280 each year until you retire.”

“Hopefully, I’ll be able to contribute more money in the future, but for our experiment, let’s assume that’s right.”

“How many years do you expect to work?”

“Make it forty, that’s about right.”

“To summarize, we want to know the future value of contributing $2,280 per year in forty years. We’ll use the return and cost ratios to estimate your expected cash when you retire.”

Ratios Translated to Dollars

“MoneyChimp and the future value formula use a single percent. That means we’ll need to start by calculating ARTMX’s average return.”

We went to spreadsheet RD1 and located ARTMX’s return ratios for years 1, 3, 5 and 10:

Year 1	-0.89 (Note, this is a negative number)
Year 3	2.29
Year 5	11.94
Year 10	8.70

I wasn't a complete klutz when it came to math. I knew how to calculate averages. If I added the heights of four people—for example, 68" + 74" +71" + 65"—and divided the sum by four, I'd get their average height, 69.5". So, for ARTMX, the average gross return ratio for years 1, 3, 5, and 10 was:

(-.89% + 2.29% + 11.94% + 8.7%) / 4 = 5.51%

"We need to subtract ARTMX's expense ratio from its average gross return ratio."

Sidebar: The relevant data for ARTMX included a significant downturn, i.e., -.89%. This occurred during a market-wide decline, which affected most, if not all, mutual funds. Recessions, as we saw during 2002-2003 and 2008-2009 in DOW, S&P, and NASDAQ charts, occur periodically. Failure to include a significant downturn risks overoptimistic expectations.

We had already identified ARTMX's 1.19% expense ratio. But Lydia reminded me of another cost.

"Let's not forget that our 401(k) provider, NBIS, also charges us a .6% fee."

"How do you know that? NBIS's charge is not shown in *THE DATA*."

"Do you remember the stack of paper we got from Ms. Tilson?"

“Yeah, but I didn’t look at it.”

“You really should. There are a bunch of additional charges, fees, and penalties buried in the small print. Right now, all we need to consider are the provider’s fees on whatever amount we have in our 401(k).”

“How can we decide which funds to pick if we don’t know what they cost?”

“We can’t. That’s why we include as many as we can identify.”

Sidebar: Your provider may charge a different fee, which will probably change over time. Every year both expense and fee ratios are charged against (subtracted from) the total dollar amount in your 401(k) account. Depending on the provider, you may see a deduction each quarter. If the yearly fee charged by your provider is .006, every three months expect a .00015 deduction from your account balance.

“The cost ratio, which we’ll call c, is the total of all fees and expenses we know about.

“Expense Ratio + Fee Ratio = Cost Ratio, c.

“The cost ratio for ARTMX is

> “1.19% + .6% = 1.79%.
> “.0119 + .006 = .0179 in decimals.”

Lydia noticed my eyes glaze over. It was my instinctive reaction to math. “Let’s take a break. I need some caffeine.”

“Me, too.”

Gross and Net Return Ratios

I've learned an important lesson. When you're tired, take a break, especially if you're working on complicated stuff. The caffeine helped. We were ready to go, again.

"Let's begin with an overview, then we'll run the numbers and discuss them. We'll identify two average return ratios. The first is *average return ratio before subtracting the cost ratio*. Call it *gross return ratio*, **GRR**.

Sidebar: There's nothing magical about the labels like GRR. They're just abbreviations to make reading easier.

"The second is *average return ratio after subtracting the cost ratio*. Call it *net return ratio*, **NRR**. GRR and NRR are used the same way as interest rates on bank deposits. Number of years until retirement, n, is like years to grow on bank deposits. And our 401(k) contributions are like deposits. We'll use GRR, NRR, n, and contributions in present value formulas, or MoneyChimp, to convert ratios to dollars. The result will be *gross return in dollars*, **GR$**, and *net return in dollars*, **NR$**.

"NR$ is our all-important cash at retirement. We'll subtract NR$ from GR$, giving us *cost in dollars*, **C$**. We'll use NR$ and C$ to make our decisions."

"Phew!"

"Yeah," Lydia agreed. "Now slowly and in detail. Let's start with ARTMX's GRR. All we need to do is total the return ratios and divide them by how many there are." Lydia wrote out the numbers.

GRR = ((-.89% + 2.29% + 11.94% + 8.7%) / 4) = **5.51%**.

"Logically, the next step is to subtract the cost ratio, c, from the GRR to get NRR." She again wrote out the numbers.

NRR = (GRR - c).

NRR = (5.51% - 1.79%) = 3.72%.

Lydia looked up from her note pad and said, “Get MoneyChimp ready to run the numbers. After we do the calculations, we’ll summarize them in English.

I clicked on MoneyChimp and was ready to go in a flash. Now, I could listen carefully to Lydia.

“Once we have GRR, c, and NRR, here’s the plan step-by-step to convert them to dollars for each fund in our lineup:

“Step 1: Calculate the expected gross return in dollars, GR$. You’ll use MoneyChimp and I’ll use a future value formula. That will give us a check on our work. The investment (deposit) is your annual expected contribution, $2,280. The “interest” rate is the gross return ratio (GRR). The number of periods is 40 years.

“Step 2: Calculate the net expected return in dollars, NR$. The only change is the “interest rate” which will be the NRR. That will give an expected net return in *dollars* (NR$) when you retire.

“Step 3: Subtract net return in *dollars* (NR$) from the gross return in *dollars* (GR$), which gives us cost in dollars. We’ll call it C$.”

“Subtraction, I can do that. GR$ – NR$ = Cost in Dollars = C$.

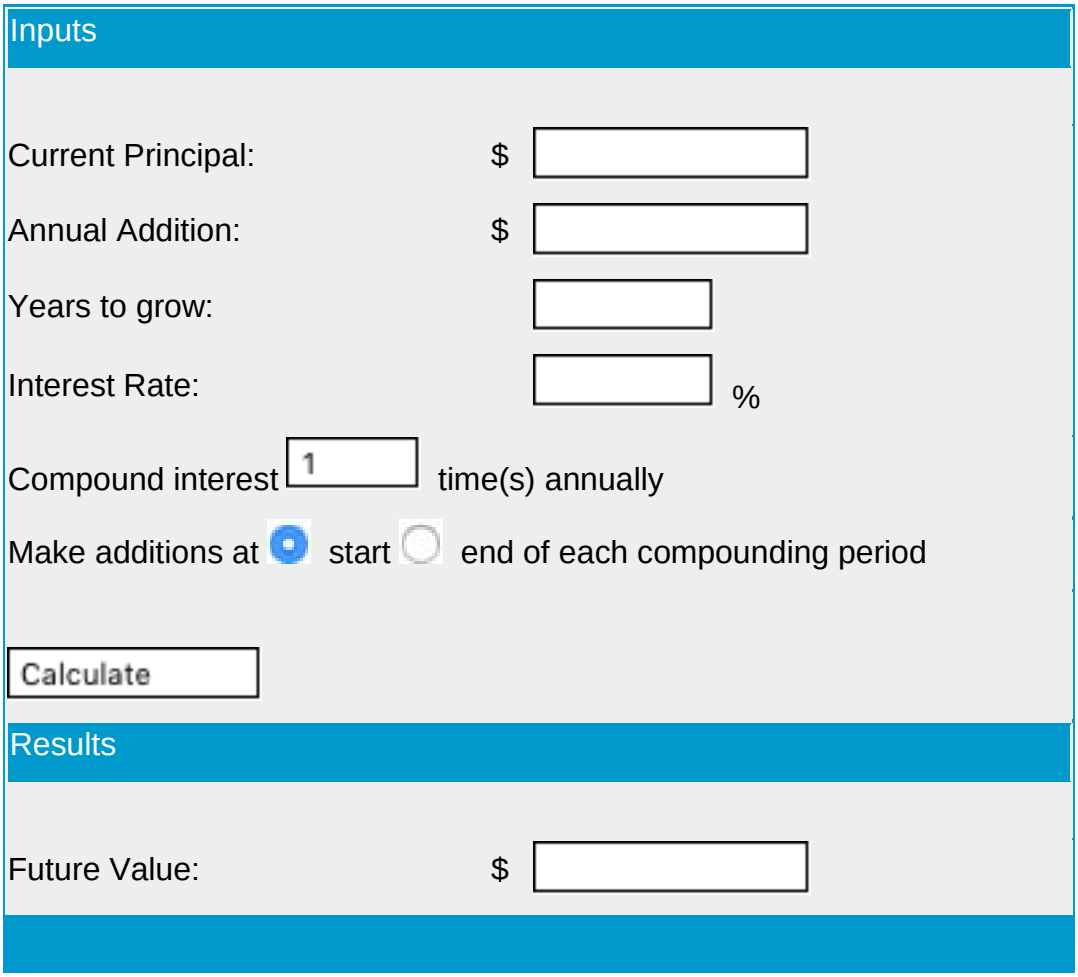
Lydia smiled and continued, “Here we go with the calculations to convert the *ratios* to *dollars.* You ready?”

“Yep.”

“Step 1: For ARTMX, input your contribution, $2,280; number of years until retirement, 40; and gross return ratio, GRR, 5.51%.”

“It’s comforting to know that if I screw up, I can just do it over again. MoneyChimp is forgiving.”

Compound Interest Calculator



I ignored “Current Principal,” because I didn’t have a rollover amount or a single amount like our bank deposit example. I typed $2,280 in the blank for “Annual Addition;” *40* in “Years to grow;” *5.51* in the blank for “Interest Rate;” *1* in “Compound interest __ time(s) annually;” and checked the box for *end* in “Make additions at __ start __ end of

each compounding period, because contributions are made as you earn your pay;" and clicked on "Calculate." The result was $312,233.65.

MATH ALERT: As a reminder, *future value formulas* require decimals instead of percentages. We'll use ARTMX's average return ratios in decimal form.

GRR is (-.0089 + .0229 + .1194 + .087)/4 = .0551.

The future value formula, which Lydia used, provides the following result:

$2,280 (((1 + .0551)^{40} – 1) / .0551) = $312,233.65 = GR$

If contributions are made more often than once a year, interest is compounded more often and the total earned increases. It also means annual contribution, interest rate, and number of periods should be adjusted. So, if deposits are made quarterly, divide annual contributions by 4 ($2,280/4 = $570), divide the interest rate by 4 (.0551/4 = .013775), and multiply the number of periods by 4 (40 x 4 = 160). The formula would look like this:

($2,280/4) [((1 + (.0551/4))^{40x4} – 1) / (.0551/4)] = $327,969 = GR$
or
$570 [((1 + .013775)^{160} – 1) / .013775] = $327,969 = GR$

For our purposes, the difference between a future value formula assuming annual contributions and one adjusting variables for quarterly contributions may be irrelevant to investment decisions. This will be apparent when Lydia and Aaron choose their mutual funds.

I looked a Lydia's math. "Your calculations confirmed MoneyChimp. $312,234."

Sidebar: Since we are estimating future dollars, we could round off the calculations. For example, we could round off the result to $312,234. Even $312,000 would be close enough for our purposes. For the time being, we prefer to run the numbers to dollars and cents to provide a check on our math.

"Let's put the numbers into English. Based on ARTMX's 5.51% GRR, we expect your annual investment of $2,280 should grow over 40 years to $312,233.65. Bear in mind we haven't subtracted costs. That may make a significant difference how much you're likely to have."

Lydia labeled $312,233.65 gross returns in ***dollars,*** GR$.

"Step 2: Run the numbers to monetize net return ratio, NRR. The only change we'll need is to use the NRR of .0372 instead of the GRR of .0551."

MoneyChimp gave us $202,884.99.

MATH ALERT

Lydia used the future value formula:

$2,280 [((1 + .0372)^{40} – 1) / .0372] = $202,884.99 = NR$

"In English, we expect an annual investment of $2,280 with a NRR of 3.72% to grow over 40 years to $202,884.99. That's what you'd expect to have in your account when you retire."

Lydia labeled $202,884.99 as NR$, net returns in dollars.

She gave me a minute to study the numbers, then asked, "If you subtract net returns in dollars from gross returns in dollars, (GR$ - NR$), what does that tell you?"

Was I starting to really understand? The answer seemed obvious. “If we subtract $202,884.99 (NR$) from $312,233.65 (GR$), we’d know what we’d expect to pay ARTMX managers and our 401(k) provider for doing business with them.” I punched the numbers into my calculator. “It would cost me $109,348.66.”

Lydia wrote a formula showing the cost in dollars:

GR$ - NR$ = C$

$312,233.65 - $202,884.99 = $109,348.66.

“Remember, mutual fund managers and 401(k) providers won’t take the full amount out of your account at the end of 40 years. They take it out a little at a time.”

“WOW! Just the same, $109,348.66 is a lot of money.”

Sidebar: Since the cost ratios are expressed in very small numbers, it’s difficult to get a clear picture of the total costs unless you convert the ratios to dollars.

“Let me make sure I understand. Our mutual fund manager and 401(k) provider would collect $109,348.66 from my total return of $312,233.65. That would leave me with $202,884.99.”

“That’s right.”

“That’s more than half of what I would get!”

“Right, again.”

“What makes it worse is I earn only $111,689.99.”

“Now it’s your turn to explain where you got your number.”

I was insufferably pleased with myself. I had finally figured something on my own. “My total investment over the years is expected to be $2,280 times 40 years or $91,200. That’s my money. The growth on my money is $202,884.99 less $91,200 or $111,689.99. So, mutual fund managers and NBIS providers get almost as much as my growth on investment.”

Sidebar: Growth on investments is not determined for each mutual fund, although it would be a straightforward calculation. We’ll focus instead on NR$, your cash at retirement.

Now I understood what Lydia meant by the high cost of mutual funds. My attitude changed. I wasn’t just learning, I really needed to know this stuff. “Finally, I think we’re making progress, although I’m not very happy about the cost. I have to admit, it’s better to know than not know. That’s for sure.

“If we use MoneyChimp, it shouldn’t take long to compare every mutual fund in our lineup. That should help us make better investment decisions.”

“I may have a more efficient way to do the calculations.”

“Really? What could be better than MoneyChimp?”

“Spreadsheets. Don’t get me wrong. MoneyChimp is great for individual calculations. But spreadsheets automate the calculations for all the mutual funds. The one we’ve already set up is a good start.”

“I hope you know how to do spreadsheets, because I sure don’t.”

“I do. But I think we’re forgetting something.

“We’re not ready to run the numbers for VFIAX and the others?”

“Almost. There’s one more recommendation your Grandmother made.”

I thought for a second, searching my memory. “Volatility!”

“She thinks it’s important. So do I. Unfortunately, the charts don’t seem to capture a measure of the ups and downs we saw. Take another look at ARTMX’s chart.”

https://www.barchart.com/etfs-funds/quotes/ARTMX/technical-chart#/technical-chart?plot=LINE&volume=0&data=MO&density=X&pricesOn=1&asPctChange=0&logscale=0&sym=ARTMX&grid=1&height=500&studyheight=100.

“It *looks* volatile, but can we compare charts and say that one fund is more or less volatile than the other?”

We pulled up VFIAX’s chart again and compared it with ARTMX’s.

They looked a lot alike but not exactly alike. The many ups and downs did not, however, tell us one was more volatile than the other. We needed a number measurement like interest rates or NRRs to give us some notion of which funds are more volatile than others.

A Volatility Measure: Standard Deviation

It had been easy to find a "Compound Interest Calculator," so we decided to look for a "Volatility Calculator."

We didn't find one, but an article discussing risk recommended calculating volatility using standard deviation. Lydia had a vague memory of standard deviation from a college statistics course. I, of course, managed to avoid statistics. Several other articles said standard deviation was a common measure of risk. We wanted to know why something called standard deviation measured volatility and why it was considered a measure of risk.

Since neither of us had a better idea, I looked for a "Standard Deviation Calculator" and found http://www.calculator.net/standard-deviation-calculator.html. The website also provided a formula so we could check our numbers.

Lydia read from the website. " 'Standard deviation is a statistic that measures how annual returns might vary from the expected [average] return. In other words, very volatile investments have large standard deviations because their annual returns can vary significantly from their average annual return. Less volatile [investments] have smaller standard deviations because their annual returns are closer to their average annual returns.' "[36]

"What does *that* mean?"

"I know how you feel. Let's run ARTMX's returns through the standard deviation calculator. The ideas may become clearer."

"I hope so!"

The instructions were straightforward. "Please provide numbers separated by comma to calculate [standard deviation]." We entered ARTMX's returns for years 1, 3, 5, and 10. The standard deviation, **s**, appeared on Lydia's screen. 0.058551800427769.

Lydia looked amused. "I don't think we'll need to be that exact. 5.9% seems good enough."

"What does it mean? Does 5.9% tell us there is a big risk or little risk or just the usual risk? How will it help us choose among the mutual funds?"

"If I understand correctly, standard deviation doesn't mean much as a stand-alone measure of risk. It only means something when we use it to compare mutual funds. That's what the instructions said. 'Standard deviation is a relative measure useful in

comparison with the standard deviation of other subjects.' Our subjects are fund returns. So, a mutual fund's standard deviation is useful in comparison with other funds' standard deviations."

"That makes sense, but what if 5.9% isn't very different from other funds' standard deviations?"

"If standard deviations are similar, volatility won't matter to our choices. If they're different, and especially if they are *really* different, they will factor into our decisions."

" '*Really* different?' That doesn't sound very exact. What frightens me is I'll be making decisions based on things I don't understand. Right now, I don't have much money involved. We're talking about several hundred dollars. If I continue to contribute and if I make good decisions, by the time I'm Grandma's age, I should have enough to retire. Hopefully. But right now, I'm not sure I know how."

"Forget about being sure. *Ain't never gonna get that.* Instead, let's take a step back and consider a measure we both understand, net returns in ***dollars***. Converting ratios to dollars allowed us a pretty good understanding of how much money we might have when we retire. So, if two funds produce similar net returns in dollars, NR$, the returns won't make much difference in our choice. One might be as good as the other. For example, we calculated NR$ for ARTMX to be about $203,000. If another mutual fund had NR$ in the neighborhood of about $202,000, we'd see there wasn't much difference. In that event, we'd look to other measures to decide between the mutual funds. The same is true of standard deviations. If standard deviations are similar, they won't make much difference in our choice. For example, ARTMX's standard deviation was 5.9%. If another mutual fund had a standard deviation of 5.8%, we'd look to other measures to decide between the funds."

I nodded agreement. "Makes sense."

“Let’s see if we can find mutual funds that seem to have significantly different standard deviations. When we find them, we can chart their return ratios in relation to their average return, just like the definition says, and see what they look like.”

I read the return ratios for each fund, while Lydia carefully typed them into the standard deviation calculator. In a few minutes, we had a standard deviation for each fund. It didn’t take long to find DODIX. Its standard deviation seemed a lot different from ATRMX’s.

Lydia summarized the two standard deviations: “ARTMX’s standard deviation at .059, approximately 6%, is almost six times larger than DODIX’s at .01, or approximately 1%.”

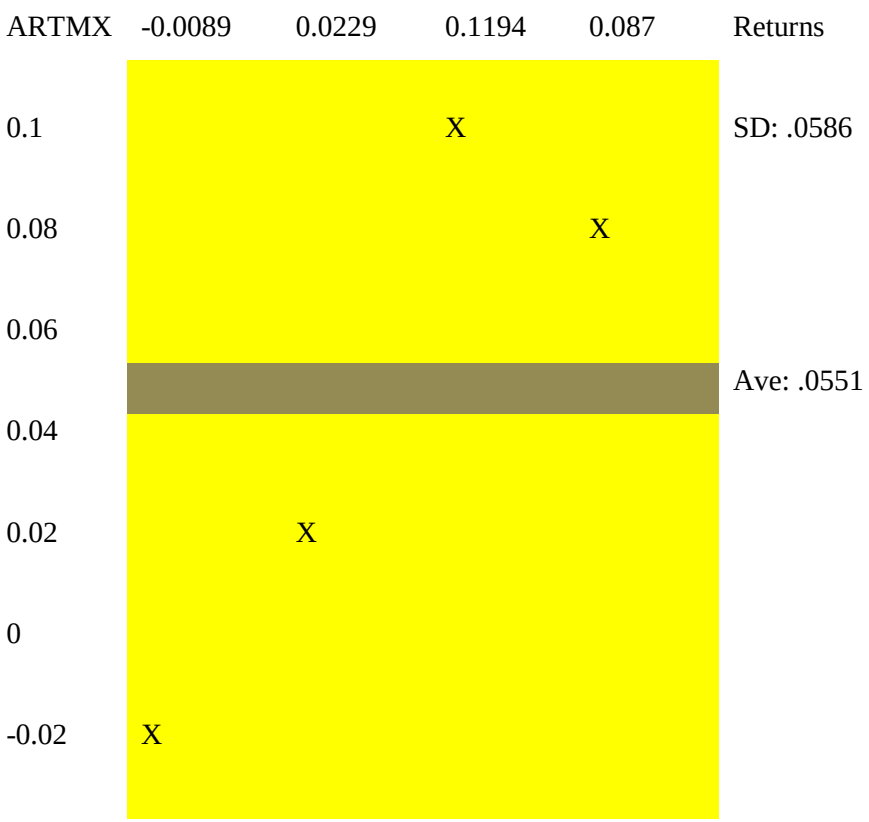
“Is that a lot?”

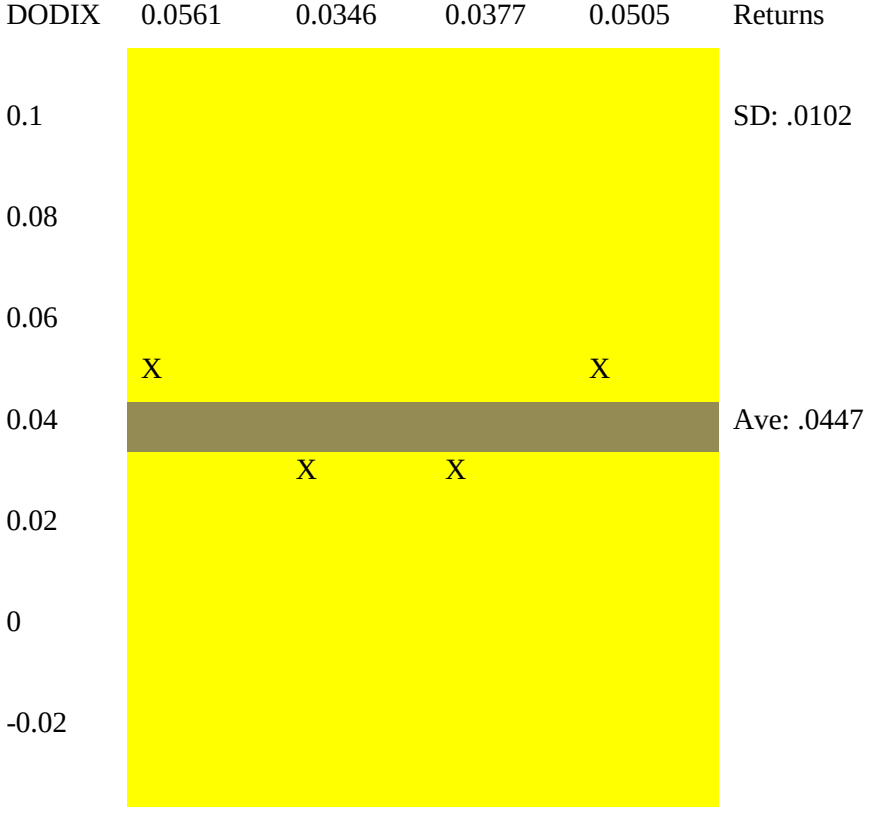
“If I had six times more debt than you, we might agree I had a lot more debt. By the same token, a fund with a standard deviation almost six times larger than another fund’s standard deviation seems noticeably larger, too.

“Let’s chart the standard deviations for ARTMX and DODIX. Are standard deviation charts and standard deviation measures consistent?”

Lydia created a chart for ARTMX to see how much the returns vary from its average return. She located the four return ratios on a chart and marked the average with a brown line.

While I studied ARTMX’s chart, she created a chart for DODIX. Its four return ratios were .0561, .0346, .0377, and .0505. The average was .0447. Again, she marked the average return with a brown line and plotted each of DODIX’s returns around it.


ARTMX -0.0089 0.0229 0.1194 0.087 Returns
0.1
0.08
0.06
0.04
0.02
0
-0.02
X
X
X
X
SD: .0586
Ave: .0551


DODIX 0.0561 0.0346 0.0377 0.0505 Returns
0.1
0.08
0.06
0.04
0.02
0
-0.02
X
X
X
X
SD: .0102
Ave: .0447

Looking at the charts side-by-side, I can see the difference. “ARTMX’s returns are a lot farther from its average (brown) line than DODIX’s. And their standard deviations match their charts. ARTMX’s standard deviation (.059) is considerably larger than DODIX’s (.01).”

I paused for a second. Something was bothering me. “Volatility doesn’t seem to be good. Is a small standard deviation good?”

“Maybe. If you have an intolerance for risk, if, for example, you’re likely to lose sleep over a volatile—highly profitable—investment, you may favor predictable returns even though the investment isn’t likely to earn much. If so, selecting investments with a small standard deviation may be what you want.”

“I think I get it. It all comes down to whether an investment might have big changes in value. That may become more important as I get older and don’t want to risk retiring in the middle of a recession. It reminds me of the what-if game when I pretended to *buy high and retire low*. The wild swing turned out to be a risk I’d prefer to avoid. One way to do that is to invest in funds with lower risk as I near retirement, like DODIX. That way I’d have a better idea of the amount of cash I’d have.”

“That’s my plan, too. I’ll want to preserve capital as I get older. I think we’re ready to run the numbers for VFIAX. Let’s see if the measures help us decide which mutual fund is better, VFIAX or ARTMX.”

VFIAX—Its returns, costs, and volatility.

“Grandma Combs probably had a lesson in mind when she picked VFIAX as a fund to compare with Ms. Tilman’s ARTMX.”

“You’re probably right,” Lydia said. “We have a better read on ARTMX’s performance in dollars than we had with just its ratios. Time to see how ARTMX stacks up against

VFIAX. Since ARTMX gives us a blueprint, it shouldn't take long to run VFIAX's numbers."

We used my retirement information to calculate VFIAX's GR$, C$, and NR$.

From *THE DATA*, we identified VFIAX's returns for years 1, 3, 5, and 10: .1193, .0884, .1462, and .0694.

Its GRR was:

(.1193 + .0884 + .1462 + .0694) / 4 = .1058.

The expense ratio was .05%; in decimal form it was .0005. Our 401(k) providers charged .6%, or .006, for every fund in our lineup. Therefore, VFIAX's cost ratio, c, was:

.0005 + .006 = .0065.

VFIAX's NRR, was:

.1058 - .0065 = .0993.

We were ready to translate the ratios to dollars:

(1) GR$: $2,280 contribution per year earning .1058 per year for 40 years.

I plugged the numbers in MoneyChimp: $2,280 for "Annual Addition;" 40 for "Years to grow;" 10.58 for "Interest Rate;" 1 for "Compound interest ___ time(s) annually;" and checked "Make additions at *end* of each compounding period." I clicked on "Calculate" and it gave me "Results": $1,182,134.23.

(2) NR$: $2,280 contribution per year earning .0993 per year for 40 years.

All I did was change the “Interest Rate” to .0993, because all the other inputs were the same, and clicked on the “Results”: $990,098.22. Based on VFIAX’s history, I could have $990,098.22 when I retire if I invested all my contributions in VFIAX for 40 years.

The provider and fund manager would get $192,036.01, which is the difference between GR$ and NR$, $1,182,134.23 - $990,098.22.

MATH ALERT

Here’s what Lydia’s calculations looked like using the future value formula:

(1) Gross return in dollars. Investments of $2,280 per year earning **.**1058 per year for 40 years:

$2,280 [((1 + .105825)^{40} – 1) / .105825] = $1,182,943.70 = GR$

(2) Net return in dollars. Investments of $2,280 per year earning .099325 per year for 40 years:

$2,280 [((1 + .099325)^{40} – 1) / .099325] = $990,770.74 = NR$

The costs in dollars, C$, was:

C$ = GR$ – NR$

C$ = $1,182,943.70 - $990,770.74 = $192,172.96

Note that there is a rounding difference between MoneyChimp and the future value formula. Rounding variations occur when there is a difference in the number of decimal places used by MoneyChimp and the future value formula.

An example of a rounding difference:

$100,000 x .09584 = $9,584.

Round off .09584 to three decimal places: .095.

$100,000 x .095 = $9,500.

The rounding variation (sometimes called a rounding error or difference) is $84.

For our purposes, the difference between the results of rounding variations are irrelevant.

Lydia organized the results so we could compare ARTMX and VFIAX.

	ARTMX	VFIAX
Gross returns in dollars (GR$)	$312,233.65	$1,182,943.70
Net returns in dollars (NR$)	$202,884.99	$990,770.74
Costs in dollars (C$)	$109,348.66	$192,172.96

"VFIAX is expected to earn about four times more cash than ARTMX. The higher cost for VFIAX seems worth it."

Lydia cautioned, "Let's not rush to judgment. Maybe VFIAX has much higher volatility. That's what we should expect, if Ms. Tilson's right: 'Greater returns should come with greater risk.' "

We had already run the numbers for VFIAX's standard deviation. We ran them again as a check, using our website calculator, http://www.calculator.net/standard-deviation-calculator.html.

Sample Standard Deviation, **s**: 0.033872936591523 or 3.4%

Once again, we wrote the results side-by-side to make it easier to compare them:

	ARTMX	VFIAX
Net returns in dollars (NR$)	$202,884.99	$990,770.74
s (risk)	5.9%	3.4%

I blurted, “That’s not what I expected.”

Lydia frowned. “Me either. Could we have made a mistake?” She quickly double-checked the numbers.

We expected higher returns to be accompanied by higher risk. Whether we ran the calculations by hand or used the internet standard deviation calculator, the numbers were the same: 3.4% for VFIAX and 5.9% for ARTMX. ARTMX had lower expected returns and higher expected risk than VFIAX.

“But in absolute dollars VFIAX costs more than ARTMX. That works to ARTMX’s advantage, doesn’t it?”

Lydia had a different idea. “In absolute dollars, you’re right. ARTMX seems to have a cost advantage. We might have better picture, though, if we divide cost by NR$. It should resolve the problem you’ve identified.

“Of course, VFIAX has higher cost than ARTMX!”

“Take a look at the numbers and tell me what you see.” Lydia wrote the cost percentages for both ARTMX and VFIAX:

ARTMX: $109,348.66 / $202,884.99 = 54%

VFIAX: $192,172.96 / $990,770.74 = 19%

“Hmm…. I see what you mean. Cost percentage puts cost in perspective.”

Sidebar: As previously mentioned, growth on investments is not calculated for each mutual fund, although it would be straightforward. Furthermore, cost as a percent of growth (C$/Growth) is not calculated. Since growth is less than NR$, cost as a percent of growth (C$/Growth) will be greater than cost as a percent of NR$ (C$/NR$).

“On all measures—net returns, risk, and cost percentage—we might expect to do considerably better by investing in VFIAX. I never would have come to this conclusion using just the ratios.”

Lydia agreed, “Me either. Shall we keep cost percentage to evaluate mutual funds?”

“It seems useful and simple enough, yeah.”

Now we were keen to know how VFIAX and ARTMX would compare with the other funds in our lineup. The obvious question, would VFIAX dominate the others, too?

Spreadsheets!

Translating ratios to dollars led us to see VFIAX as an historically better performer than ARTMX. But if Lydia and I were going to compare all the mutual funds in our lineup and choose the best, we wanted to be more efficient. The answer, spreadsheets.

We spent the next several hours developing a spreadsheet—or rather enhancing RD1 Lydia already started. Our goal was to tweak the design so that it would readily accommodate a variety of 401(k) contributions, rollovers, and years until retirement.

Sidebar: A spreadsheet can be constructed in many ways. You can design your own. If you aren’t comfortable setting up a spreadsheet, modify one of ours. Change our tickers, ratios, and investment assumptions to yours. It will run the numbers for you in dollars. We’ll show you how to do it.

We were now going to add to RD1 so that we could compare our mutual funds. Lydia made a copy of RD1 and named it RD2.

RD2.xlsx

“RD1 is a backup. If I make a mistake, I won’t have to start from scratch.”

Sidebar: If you click on the spreadsheet icon, it will enlarge to full size and be interactive. RD2 is Lydia’s completed spreadsheet. It may be helpful to print a copy to have in front of you as Lydia walks you through the details.

Lydia prodded, “Ready?”

“I’m ready,” Aaron said more confidently than he felt.

She started at the left-most column. “Your retirement assumptions are in cell A2, which is the intersection of column A and row 2. I’ve color-coded the information in the spreadsheet. The tickers, return ratios, and expense and fee ratios are in BLACK, columns A through G.”

Sidebar: A few reminders may be helpful. Tickers, column A, are the abbreviated names of the mutual funds. They identify one and only one fund. Return ratios, columns B through E, are the past growth (or losses) of fund investments. Expense ratios, column F, are costs charged by the fund managers. The fee ratios, column G, are costs charged by the 401(k) provider, NBIS in our case. The fee ratios were not included in *THE DATA* or RD1, but are now included in RD2. All ratios are expressed in decimals. Also note that the tickers and ratios in columns A through G were actually provided to participants in a real company’s 401(k).

Lydia put ARTMX and VFIAX at the top of the list, rows 4 and 5. She colored them light grey and explained, “I want to confirm our spreadsheet calculations. Look at columns N through R and compare them with the results we worked by hand on pages 61 - 80. For example, net returns in dollars, NR$, for ARTMX and VFIAX reported in cells O4 and O5 are $202,885 and $990,771, the same as we determined by hand. Now we can run our numbers three ways: using a hand-held calculator, an internet calculator, and a spreadsheet. If you choose to follow the math, the spreadsheet formulas may look different but, subject to some small rounding differences, they produce the same results. You don’t have to do the math. The spreadsheets will do it for you.”

“Phew!”

Lydia smiled while getting right back to the spreadsheet. The investment assumptions were next.

“Columns H through J, which are in red, report current investment assumptions: $2,280 contribution per year for 40 years, which totals to $91,200.”

Sidebar: When you click on a cell, its address and content are shown above line 1. For example, click on cell H4, and its address, “H4”, is shown on the left-most side and its content, “2280” is on the right side of “*fx*.”

The first of many spreadsheet tricks Lydia showed me was a really cool shortcut. When she input $2,280 in cell H4, she highlighted cell H4 and dragged the highlight from cell H4 down to and including H23. The spreadsheet copied $2,280 in every highlighted cell. A real timesaver, especially useful when we get to the formulas.

MATH ALERT

In column J, we multiply two numbers. Traditionally, it looks like this: $2,280 x 40 = $91,200. The spreadsheet does the multiplication via =H4*I4. Spreadsheets require their own mathematical symbols. Multiplication is carried out with an asterisk, *; raising to a

power is accomplished with a caret, ^; and addition is done with the SUM function. We'll show you how they work as we construct the spreadsheet.

Click on cell J4. It shows $91,200. A formula is embedded in J4. It does the calculation in spreadsheet math: =H4*I4. So, if cell J4 were blank and you wanted the product of cells H4 and I4, you'd click on cell J4 and type =H4*I4. $91,200 would appear on the face of J4. The content of J4, =H4*I4, appears on the right side of *fx* above row 1.

Using Lydia's shortcut, highlight cell J4 and drag the highlight down to and including cell J23. The spreadsheet copies the formula and calculates total investment for each mutual fund.

"Columns K through M are green. Column K includes gross return ratios, GRRs, which are average return ratios before subtracting the cost ratios. Column L includes c, the cost ratios. Column M includes NRRs, the average return ratios after subtracting the cost ratios."

MATH ALERT

GRR, gross return ratio, was calculated for ARTMX on pages 61 through 62 using the formula, GRR = (B + C + D + E) / 4. The formula in spreadsheet math in cell K4 looks like this: =SUM(B4:E4)/4. It says "add the ratios in cells B4, C4, D4, and E4 and divide the sum by four." Both formulas produce the same result: .0551. Highlighting cell K4 and dragging the highlight down to and including cell K23 calculates GRR for each mutual fund. This is the procedure we'll use to copy formulas in each column.

The cost ratio, c, was calculated for ARTMX using the formula, c = Expense Ratio + Fee Ratio. The formula in spreadsheet math in cell L4 looks like this: =(F4+G4). It says "add the ratios in cells F4 and G4." Both formulas produce the same result: .0179. We copied cell L4 throughout column L.

NRR, net return ratio, was calculated for ARTMX using the formula, NRR = (GRR – c). The spreadsheet math in cell M4 looks like this: =(K4-L4). It says, “subtract the ratio in cell L4 from the ratio in cell K4. Both formulas produce the same result: .0372.

Columns N through R are blue.

Column N, *returns in dollars before deducting costs*, GR$,
Column O, *returns in dollars after deducting costs*, NR$,
Column P, *costs in dollars*, C$,
Column Q, risk (standard deviation), s, and
Column R, Cost Percentage, C$ / NR$.

We used O, P, Q, and R to compare ARTMX to VFIAX. Our conclusion was to favor investing in VFIAX over ARTMX. See, pages 77 through 79.

MATH ALERT
GR$ for ARTMX was calculated on pages 64 through 65 using MoneyChimp and in a MATH ALERT with the future value formula, Investment x (((((1 + r)^n) – 1) / r)). In the spreadsheet, the future value formula is: =H4*(((((1+K4)^I4)-1)/K4)). Both formulas produce the same result: $312,234.

NR$ for ARTMX was calculated using MoneyChimp and in a MATH ALERT with the future value formula, Investment x (((((1 + r)^n) – 1) / r)). The formula in spreadsheet math looks like this: =H4*(((((1+M4)^I4)-1)/M4)). Both formulas produce the same result: $202,885.

C$ for ARTMX was calculated using the formula C$ = GR$ – NR$. The spreadsheet formula is: = N4-O4. Both formulas produce the same result: $109,349.

Standard deviation for ARTMX was calculated using the Standard Deviation Calculator, http://www.calculator.net/standard-deviation-calculator.html. The spreadsheet formula is: = STDEV(B4:E4). Both methods produce the same result: 5.9%.

The cost percentage for ARTMX was calculated using C$ / NR$. The spreadsheet formula is: =P4/O4. Both formulas produce the same result: 54%.

Lydia emailed me the completed spreadsheet they'd been working on. "It's on its way."

While I waited for the spreadsheet to hit my email, we stretched, talked about work, took a few sips of our sodas, and got right back to it. Lydia was going to walk me through RD2 one step at a time.

"Columns A through J are our tickers, ratios, and your investment assumptions. You already know what those are. Let's spend our time on columns K through R. We ran the numbers for VFIAX and ARTMX, so they should look familiar.

"Look at cell K4. It adds B4, C4, D4, and E4 then divides the total by 4. That gives us ARTMX's gross return ratio, GRR, .0551. Each cell in column K is calculated the same way."

I paraphrased Lydia's ideas so I could be sure I understood correctly. "So, the spreadsheet calculates GRR for ARTMX in cell K4. But I don't see a formula in K4. I see .0551."

"Click on cell K4 and it will show the formula.

"I still don't see it."

Lydia pointed at the function line, *fx*, above row 1, which showed:

=SUM(B4:E4)/4

“That formula is embedded in cell K4. It’s mathematically the same as GRR = (B4 + C4 + D4 + E4) / 4. You don’t see the spreadsheet formula unless you click on cell K4. If you don’t click K4, you only see the result, .0551.”

Finally, I saw what Lydia was pointing at, but it didn’t help much. “That doesn’t look like any of the formulas we used.”

“Spreadsheets have their own language. The formula, =SUM(B4:E4)/4, tells the computer to add—sum—cells B4 through E4 then divide the sum by 4. The spreadsheet formula and the traditional formula give the same result: .0551.”

I followed up in my own words: “So, cell K1 shows the formula, GRR = (B + C + D + E) / 4. It is just a label reminding us how we would do the calculation by hand. But it doesn’t do the calculations in the spreadsheet. Embedded in K4, for example, is the spreadsheet formula, =SUM(B4:E4)/4. It actually does the calculation for ARTMX’s GRR.”

“Right. Once we’re familiar with spreadsheet formulas, like =SUM(B4:E4)/4, we can use them to label the columns. Of course, we can label the columns anything we want, but I like to label them something that tells us what’s going on.”

“Let’s stick with describing the columns in English for the time being.”

“We can do that. Now here’s the really cool stuff. Once we embed a formula in a cell, like =SUM(B4:E4)/4 in K4, and highlight the cells in the column K4 down to and including cell K23, the spreadsheet will do the calculations. In this case it will calculate GRR for cells K4 to K23. It’s a real time-saver.”

I checked several of the numbers in column K to see if they really were accurate. They were. “That’s really cool!”

“In column L,” Lydia continued, “we calculate the cost ratios:

“c = Expense Ratio + Fee Ratio.

“I embedded its spreadsheet formula, =(F4+G4), in cell L4. It calculated the cost ratio for ARTMX. We copied cell L4 throughout column L.

“Let me back up and talk about columns F and G for a minute. Column F shows that expense ratios are usually different for each fund. In ARTMX’s case, the expense ratio was .0119 and was reported in F4. Since NBIS charges .006 on all mutual funds, column G is the same for every fund. ARTMX’s cost ratio, c, in L4 is .0179.

“c = .0119 + .006.

“Once the spreadsheet formula, =(F4+G4), was embedded in cell L4, I highlighted cells from L4 to L23 and the spreadsheet calculated c for every fund.”

I began to catch on as I listened to Lydia follow the same routine in column M as she did in columns K and L.

“Column M lists the NRRs.

“The heading, which is cell M1, shows NRR = (GRR – c).”

Lydia embedded =(K4-L4) in M4.

“On the face of cell M4 is .0372.

“After the spreadsheet formula, =(K4-L4), is embedded in M4, I used the copy procedure. The spreadsheet calculated the NRRs for each mutual fund.

“Next is the good stuff, converting ratios to dollars.”

My stomach began to growl. I was hungry. “Before we convert these ratios to dollars, let’s have lunch. Our break tomorrow will be soon enough to tackle future value formulas.”

Converting Ratios to Dollars

The next day, we were ready to continue the “good stuff.” For me, too much detail in one sitting doesn’t work. I needed a fresh mind to think clearly.

“Ready to convert ratios to dollars?”

“Let’s do it. Maybe I can continue to get hold of the math, now that I have a good reason to learn. Of course, I don’t want to do all those calculations by hand.”

As usual, Lydia didn’t waste any time with small talk. “Beginning with column N and continuing through column R in spreadsheet RD2, I converted ratios to dollars. I’ll start with cells N1 through N3. They say ‘Returns in Dollars Before Subtracting Costs, GR$’.”

Lydia clicked on N4. “The spreadsheet formula for ARTMX to calculate GR$ is—” She abruptly stopped, turned her computer toward me, and pointed at the embedded formula: =H4*(((((1+K4)^I4)-1)/K4)). “It’s an instance of the traditional formula.”

She wrote out: Annual Investment x (((((1+r)^{n}) -1)/ r)).

“Both calculate the same GR$, $312,234.”

I stared at the two formulas for a minute. “I think I’m beginning to get it.”

“The computer does the work. MoneyChimp did it for us when we ran the numbers for VFIAX and ARTMX. The spreadsheet does it for us now.

“Next is column O. Cells O1 through O3 are labeled ‘Returns in Dollars After Subtracting Costs, NR$’.” She clicked on O4, turned her computer toward Aaron, pointed at the embedded formula, =H4*(((((1+M4)^I4)-1)/M4)), and said, “The formula you see in the function line, *fx*, calculates ARTMX’s NR$, $202,885.”

Lydia paused. She was thinking, no doubt about it. I didn’t peep.

She slowly started, “It occurs to me if I write out the math logically, maybe we can improve your understanding even more. She opened a document on her computer and began typing. I watched over her shoulder.

A Summary of the Future Value Formula

Our contributions are annual investments (**AI**). The traditional formula for the future value of annual investments earning **r** returns for **n** years is:

$$AI\ (((((1 + r)^n) - 1) / r))$$

It calculates the NR$ and GR$ in columns O and N, respectively. The results are different because columns O and N use different returns. For ARTMX, column O’s return is NRR, .0372, while column N’s return is GRR, .0551. Their future value formulas are:

Cell O4 uses NRR, .0372: $\$2,280\ (((((1 + .0372)^{40}) - 1) / .0372)) = \$202,885.$
Cell N4 uses GRR, .0551: $\$2,280\ (((((1 + .0551)^{40}) - 1) / .0551)) = \$312,234.$

Embedded in cells O4 and N4 are the spreadsheet formulas. They are the same as the traditional future value formulas but with different symbols. * means multiply, ^ means raise to the power n times.

Cell O4: =H4*(((((1+M4)^I4)-1)/M4)), which on the face of O4 shows $202,885.
Cell N4: =H4*(((((1+K4)^I4)-1)/K4)), which on the face of N4 shows $312,234.

They too are the same spreadsheet formula but they use different returns and produce different results. Cell O4 takes its return from cell M4, .0372, and cell N4 takes its return from K4, .0551.

Cell O4 calculates the expected future value of an annual investment of $2,280 for 40 years given a rate of return of .0372, that is, $202,885. Cell N4 calculates the expected future value of an annual investment of $2,280 for 40 years given a rate of return of .0551, that is, $312,223.

Lydia emailed a copy to me. I said, “I’ll need to study it. But I think you’ve gone a long way to demystify the math we’re using. There seems to be a rhythm to it.”

“Let’s do some more. Column P is cost in dollars. The formula in cell P2 is

“C$ = GR$ – NR$

“Cell P4 reports cost in dollars for ARTMX. Its formula is

“C$ = $312,234 - $202,885 = $109,349.

“The spreadsheet version is: =N4-O4, which is embedded in cell P4.

“Column Q measures risk using standard deviation. See Q4: s = 5.86%. Its formula is embedded in Q4: =STDEV(B4:E4).

"Column R is the Cost Percentage, C$ / NR$. It's exemplified by ARTMX in cell R4: Cost Percentage = $109,349 / $202,885 = .54 or 54%. The formula we embedded in R4 is =P4/O4."

"I think I'm getting used to the math." I smiled. "*Almost*."

Checking Our Numbers

As a test of our spreadsheet's reliability, Lydia and I confirmed its numbers. We had performance measures calculated by hand and MoneyChimp for ARTMX and VFIAX. See, pages 76 through 79. With RD2 in front of us, we compared ARTMX's cells O4, P4, Q4, and R4 and VFIAX's cells O5, P5, Q5, and R5 with the numbers previously calculated.

	ARTMX	VFIAX
Returns in dollars *after* costs (NR$)	$202,884.99	$990,770.74
Costs in dollars (C$)	$109,348.66	$192,172.96
s (risk)	5.9%	3.4%
Cost Percentage	54%	19%

The spreadsheet calculations produced the same numbers. Our conclusion was the same: VFIAX clearly outperformed ARTMX.

"Now, how will they stack up against the other mutual funds in our lineup?"

"Let's get to it!"

With the spreadsheet completed and its accuracy confirmed, Lydia and I were ready to analyze the other funds in our lineup and make investment decisions. We were motivated to get to it. Ms. Tilson had told us that our contributions would automatically be deposited in a Qualified Default Investment Alternative (QDIA), if we didn't pick our

own investments. I remember the cliché she attributed to QDIA: *'No decision is a decision.'*

Sidebar: The Department of Labor issued a regulation to help 401(k) administrators select Qualified Default Investment Alternatives.[37]

Our company used target-date funds as QDIAs. For anybody who doesn't pick funds from the lineup, a QDIA would be selected based on their expected retirement date. If someone planned to retire around 2040 and didn't choose any fund, NBIS would automatically put their 401(k) money in VFORX, Vanguard Target Retirement 2040.

Sidebar: Many mutual fund companies offer retirement-date funds. Our example uses Vanguard's retirement-date funds because they were in a lineup actually offered by a provider. Your 401(k) may include retirement-date funds.

Vanguard reports that its retirement date funds are "… a diversified portfolio within a single fund that adjusts its underlying asset mix over time. The funds provide broad diversification while incrementally decreasing exposure to stocks and increasing exposure to bonds as each fund's target retirement date approaches."[38]

Although investing in retirement-date funds wouldn't be the end of the world, we wanted to do our own analysis and make our own decisions. We might choose to invest in a retirement-date fund, but we wouldn't know until we ran the numbers.

We included Vanguard Target Retirement 2040 Inv, VFORX, in RD2, row 23. VFORX had a retirement date similar to the 20 years we expected to use in Lydia's retirement assumptions. We'll run her numbers later. Since a participant would be assigned to only one QDIA, we didn't include the other retirement-date funds that were listed in *THE DATA*.

Sidebar: The other retirement-date funds could be included in the spreadsheet by adding their tickers and return and cost ratios.

We were ready to evaluate the remaining funds. Boy, was I glad Lydia had put together the spreadsheet. Even dividing up the work, running the numbers with a handheld calculator or MoneyChimp would have taken a long time.

Minor Problems

We quickly identified two relatively minor problems: VEVRX, row 11, and TRREX, row 19.

VEVRX reported returns for years, 1, 3, 5, and 10. We could confirm its returns for years 1 and 3, but not for years 5 and 10. A little research showed that it had existed for only about 3 years.[39]

Lydia was spot on. “VEVRX can’t have returns for ten years, if it existed for only three. Every public source we checked confirmed its ‘Inception Date: March 04, 2014’.”

Sidebar: Although you’ll often see returns for 1, 3, 5, and 10 years, returns may also be reported for years since inception. “Since inception” means when a mutual fund started, usually fewer than 10 years ago.

I wondered, “Did VEVRX make up returns for years 5 and 10?”

“Good question.”

Lydia and I agreed we wouldn’t consider VEVRX in our analysis, at least until we got an explanation from NBIS.

Sidebar: If returns are inconsistent with information reported by reliable, public sources, the mutual fund should be approached cautiously until the question is resolved. Errors may not be intentional. They occasionally occur in large data sets.[40]

The second problem was easier to solve. Our employer had recently dropped TRREX from our lineup.

Sidebar: The plan sponsor or provider may change the mutual funds from time to time. Among the reasons is to improve the lineup.

We colored rows 11 and 19 in yellow, marking them for deletion. Without VEVRX and TRREX, we were left with eighteen mutual funds.

"It looks huge!"

When I paused to take a good look at RD2, my optimism sank. "It's a bigger matrix than *THE DATA*. It looks huge!"

Lydia had the cool head. "We need all that information for our calculations, but we don't need to see all of it to make decisions. We can hide some of the columns."

"Hide columns?"

"We can collapse the number of columns to just the ones we want to see. The ones we hide are still there doing their job and can be unhidden anytime we want. Deciding which columns to hide may take a little thought. But we have a more important problem. The information in the blue columns helped us decide the better performer, VFIAX over ARTMX. Now, we've got eighteen mutual funds to assess. How do we use the information in the blue columns? What's a good place to start?"

"I've got an idea. One Grandma Combs taught me."

“While you’re working on that, I’ll figure out which columns we can hide.”

I began typing the ideas we intuitively used to pick VFIAX over ARTMX. I started with something Grandma had said: “More cash is better than less.” It seemed obvious and was said as a joke. Now, I realize it had a serious side, but it needed to be balanced with other performance measures in the blue columns. More cash is better than less could, however, lead the process of choosing mutual funds:

1. NR$. It’s CASH at retirement:

More CASH is better than less.

2. Cost in dollars, C$:

The lower the cost, C$, the better. In other words, what 401(k) providers, mutual fund managers, and advisors don’t get, I do.

3. Standard deviation, s:

A smaller s means less volatility, less risk; a larger s means more volatility, more risk. Generally, we’d expect greater NR$ to be accompanied by greater risk, s, which, as we’ve learned, isn’t always true.

4. Cost as a percent of expected NR$, also known as cost percentage, (C$ / NR$):

The smaller the cost percentage the better.

I labeled them rules of thumb, printed a copy, and placed it between us. Lydia read it as I said, “*More cash is better than less.* That’s where we begin.”

Lydia was ready to show me how and what to hide in our spreadsheets. “In a nutshell, we can hide all the columns except the ticker column and most blue columns. Let me show you.”

Sidebar: Hide and unhide can be accomplished with Microsoft Excel spreadsheet: Home → highlight an empty row, which identifies the columns to hide or unhide → Cells → Format → Hide/Unhide. If you’re unsure how to hide columns, check the “help” function.

Lydia hid columns B through N, which disappeared leaving columns A and O through R.

RD2.HIDE.xlsx

RD2 (Showing columns A and O through R)

“The hide function let’s us see just the columns we want to use. We can unhide the columns any time.

“In my humble opinion,” Lydia continued, “we’re ready to apply your four rules of thumb.”

“Okay. Run your finger down column O, NR$. We’ll start with the mutual fund that has largest dollar amount.”

Lydia was quick with an answer. “The best NR$ is VSMAX at $1,481,197, in O14. It’s an index fund which invests in small cap equity stocks.”

I agreed. “VSMAX outperforms the second best, VFIAX, at $990,771.”

“Oops.”

Lydia's tone of voice seemed to say, "Hey, a thought just stopped me dead in my tracks."

"VFIAX invests in large cap companies. VSMAX invests in small cap companies. They're apples and oranges."

"Pardon?"

"Our rules of thumb are important. They seem reasonable. But we're missing a fundamental idea. Let's compare similar mutual funds."

"Does it really matter whether they are alike or not? We go for the fund that generates the most cash, don't we?"

"Yes, it matters, if you want true diversification. WorldCom taught me to think of diversity in terms of a comprehensive strategy. While a mutual fund is better than a single stock, one fund may not protect from the variety of stock market risks. If small caps fall out of favor, large caps may do better. If interest rates increase, bond funds may outperform equity funds. I want to protect against risks not covered by a single mutual fund."

"I hadn't thought of that. Maybe we should add diversification to our other rules of thumb."

"Definitely."

"Okay, Rule 5: Diversify, diversity, diversify. I assume we'll categorize our funds, large cap, small cap, bond, etc."

"Yeah. If I diversify with a small cap fund, I'll pick the overall best small cap fund. If I diversify with a large cap fund, I'll pick the overall best large cap fund. And so on.

Sidebar: Small cap corporations have market capitalizations of $250 million to $2 billion. Large cap corporations have market capitalizations of $10 billion or more. Large cap funds tend to be less volatile than small cap funds. Investing in a large cap fund like VFIAX and a small cap fund like VSMAX may help diversity your portfolio.

“Are there any small cap equity funds in our lineup we can compare with VSMAX? Same goes for large cap funds? Are there any large cap equity funds we can compare with VFIAX?”

I shook my head. “I didn’t know.”

Sidebar: A fund’s category can be identified by its investment objective. For example, here’s VFIAX’s investment objective. “The investment seeks to track the performance of a benchmark index that measures the investment return of large-capitalization stocks…”[41]

We ran a computer search of each ticker to identify its category: large cap equity included VFIAX, MEIKX, and HACAX. Mid cap equity included ARTMX and VIMAX. Small cap equity included DHSIX, VSMAX, and ACWDX. Balanced and commodity funds included DODBX and SKIRX. Bond funds included DODIX, VBTLX, HWHAX, and BPRIX. Foreign funds included TCIEX, RERGX and VREMX. Last was the retirement date fund, VFORX.

I was frustrated. “Why didn’t NBIS categorize the funds? It seems important to our decisions?”

“They should have, but the good news is we’re learning. We’ll keep at it. If others can understand this stuff, so can we.”

“We have to take control. It’s our money. Our retirement. Our responsibility.”

“That sums up my attitude, too. This is a good place to stop. Tomorrow is Saturday. I can break away for the entire afternoon.

“That’s good for me, too.”

Saturdays Are Free

Saturday afternoon would give us lots of time to work. Until then, I grouped the funds according to the type of investment. I saved RD2 as RD3. The two spreadsheets are currently the same. I kept RD2 as a backup and worked on RD3.

I arranged the funds so that the large cap funds were in rows 5 through 8; mid cap funds, rows 10 and 11; small cap funds, rows 13 through 16; balanced funds, rows 18 and 19; bond funds, rows 21 through 24; foreign funds, rows 26 and 27; and a retirement-date fund, row 29. I labeled them in column S. The result was:

RD3.xlsx

Lydia caught up with me as I finished grouping our mutual funds.

Looking over my shoulder, she said, “I like the new organization.”

“Thanks. I should have learned spreadsheets a long time ago.”

“It’s never too late.”

“Yes, ma’am.”

“Email me a copy.”

“On its way.”

Before we applied our rules of thumb, we hide columns B through N. The remaining columns, A and O through R, were relevant to our decisions. Now we had a manageable data set.

We were ready to make decisions and returned to the fund with the largest anticipated NR$, VSMAX, a small cap equity index fund with expected cash in the amount of $1,481,197, located in O14. Its risk measure was 5.4% and cost percentage 20.7%.

“Among the other small caps is DHSIX, row 13. Its expected NR$ was $628,013. Its risk measure was 4.6% and cost percentage 54%.”

“Oops.”

“Oops, again?” Lydia certainly knew how to get my attention.

Lydia typed, “Closed” in S13. “When we copied the ratios from *THE DATA*, I noticed the comment next to DHSIX. I got distracted and didn’t follow-through then.”

“Closed?”

“Right. If my memory serves me, “closed” means that a fund doesn’t accept money from new investors. Old investors can still invest in it, but that leaves us out.”[42]

“That doesn’t make sense. Wouldn’t fund managers want more investors? That’s how they make money. Taking a percent of assets. The more assets, the more money they make.”

“It would seem that way.” Lydia quickly googled “closed fund.” “Here’s an explanation: ‘Excessive fund inflows can cause asset bloat which makes it challenging for managers to make investments in line with the fund’s strategy. This can lead to higher cash levels—

they don't make much money on cash—and inefficient management of capital. Closed funds can be common in actively managed strategies [managed funds] for this reason. Comparatively, passive [index] funds will not be challenged by choosing assets [investments] and therefore are less susceptible to fund closings.' All in all, I think this means that if funds get too big they are too complicated to manage." [43]

"Okay, now what?"

"Look at the funds we're left with:"

	CASH (NR$)	C$	Risk (s)	C$/NR$
VSMAX	$1,481,197	$307,073	5.4%	20.7%
ACWDX	$87,647	$42,986	9.0%	49.0%

"It's a no-brainer. Given our rules of thumb, VSMAX is by far the best small cap performer. We would expect about seventeen times more cash with half the risk."

No sooner had I finished my conclusion than Lydia said, "Oops."

This was going to be more complicated than I expected.

"We're not through with ACWDX. Unhide the columns and look at cell E15."

"We only have three return ratios for ACWDX, but we're dividing by four in cell K15."

A web-search confirmed ACWDX had come into existence on November 3, 2010. We also found a "since inception" return of .0785.

"Let's use ACWDX's 'since inception' ratio to fill in for the missing E15 return and see if it makes any difference to our decision."

Lydia and I were definitely becoming aware of details. Here, we in effect were doing two things. We confirmed our decision to drop VEVRX, at least temporarily, for a data failure but affirmed keeping ACWDX in our analysis. Although ACWDX had existed less than ten years, it didn't report returns for years it didn't exist. VEVRX did report returns for years it didn't exist. VEVRX management and NBIS may have had a good reason to provide returns for years it didn't exist, but Lydia and I were already making enough estimates. Lydia suggested that we make a list of questions to ask NBIS, including why we were provided return ratios for VEVRX for years it didn't exist. Their answers might change our decision to exclude it from our analysis and decisions.

Lydia created a second row for ACWDX, row 16, copied row 15, and pasted it in row 16. She included the "since inception" return of .0785 in E16 and the spreadsheet immediately calculated new results for ACWDX.

ACWDX now had an expected NR$ of $130,704, cost of $72,063, risk at 7.8%, and cost percentage of 55%.

"Although ACWDX looks better, from my point of view the decision is still an easy one. VSMAX shows ten times more cash than ACWDX with lower risk and lower cost percentage."

We summarized our results:

	CASH (NR$)	C$	s	C$/NR$
VSMAX	$1,481,197	$301,076	5.4%	20.7%
ACWDX	$130,704	$72,063	7.8%	55.1%

Lydia was quick with another observation. "A comparison of VSMAX and ACWDX is another example of when risk and return are not what we might expect. ACWDX's expected risk at 7.8% is greater than VSMAX's 5.4%, but VSMAX's expected NR$ is *much* greater than ACWDX's."

“If I diversify with a small cap equity fund, I’d go with VSMAX.”

“It looks like a good investment to me, too.”

Next!

Back we went to column O, NR$. The next best was VFIAX. It and TCIEX were large cap index funds. MEIKX and HACAX were large cap managed funds.

“Identifying the large cap with the most cash is straightforward.”

“True, but is it the best large cap on all or most of our rules?”

	CASH (NR$)	s	C$	C$/NR$
VFIAX	$990,771	3.4%	$192,173	19.4%
MEIKX	$976,748	4.1%	$346,172	35.4%
HACAX	$364,598	5.3%	$137,615	37.7%
TCIEX	$114,321	3.5%	$17,085	14.9%

We weren’t interested in investing in HACAX or TCIEX. They had much weaker expected NR$ with greater or similar risk measures in comparison to VFIAX or MEIKX. VFIAX and MEIKX appeared to be a tossup with regard to expected cash and risk both slightly favoring VFIAX. The expected cost ratios supported VFIAX. Lydia and I both prefer index funds to managed funds, which tipped the balance clearly in favor of VFIAX.

Sidebar: Consistently beating the market is difficult for anyone including professional advisors at managed mutual funds.[44] All in all, studies suggest that managed funds are often not as successful in the long-term as index funds.[45] [46] Nevertheless, it might be tempting to invest in both VFIAX and MEIKX since both were high performance large cap funds. That might be redundant, but there is no law against it.

Balanced Funds Were Next

Lydia located the fund with the next-best expected NR$, DODBX, at $919,591 in O18. DODBX is a large cap *balanced fund,* which invests in both equities (stocks) and debt instruments (bonds).

"Since VFORX, a QDIA, also includes equity and debt investments, let's group it with the balanced funds. I'd like to see how they compare."

"Good idea." Lydia pointed at the computer screen. "Let's also not forget SKIRX. It hasn't done nearly as good as VFORX or DODBX, but let's follow-through with our routine. That way we're less apt to overlook a worthwhile mutual fund."

Lydia summarized the performance results for the balanced funds in our lineup:

	CASH (NR$)	C$	s	C$/NR$
VFORX	$403,513	$87,099	2.8%	21.6%
DODBX	$919,591	$331,734	5.0%	36.1%
SKIRX	$66,626	$22,731	7.5%	34.1%

"SKIRX is out of the running. A very weak expected cash and a high expected risk measure."

Lydia nodded. "True. Although DODBX has about twice the expected cash as VFORX, there's a glitch to an unambiguous choice. The common wisdom is that a high return usually accompanies high risk. This is the first time we've actually seen it happen."

Lydia and I paused to take a closer look at the expected risk associated with VFORX at 2.8% and DODBX at 5.0%. DODBX has about one and a half times the expected risk as VFORX.

“Now what?” I wondered aloud.

The question we were left with was, is the potential for greater return enough to offset greater volatility? We didn’t want to risk our hard earned money, but double the expected cash could be a lot of extra money for retirement.

Sidebar: Trade-offs between risk and return are normal. Risk tolerance, in the jargon of financial advisors, may influence decisions as exemplified by the choice between DODBX and VFORX.

Is the additional expected return from DODBX worth the additional expected risk? If the risk is not troubling, DODBX might be a better choice. If, on the other hand, you are risk averse, you might rationally choose to invest in VFORX with an expected risk measure of 2.8%.

Only you know your risk tolerance. In truth, there is no algorithm or formula that provides an answer.[47] Remember, any market investment has risk.

Lydia seemed more risk averse than I was, but she might surprise me. Because I had more time to wait out downturns in the market, I was inclined to choose DODBX.

We were ready to continue.

Next: Mid Caps

Lydia pointed at VIMAX. “Its an index fund with expected cash of $893,247. The other mid cap is ARTMX, a managed fund. We’re familiar with it.”

“What exactly is a mid cap?”

Lydia googled “mid cap” and paraphrased it. “They invest in companies whose market capitalization ranges from two billion to ten billion.”

We went to our decision data in rows 10 and 11:

	CASH (NR$)	C$	s	C$/NR$
ARTMX	$202,885	$109,349	5.9%	53.9%
VIMAX	$893,247	$181,074	3.2%	20.3%

“We have another fairly easy decision. VIMAX is expected to generate four times more more cash, have roughly half the risk, and a smaller cost percentage than ARTMX. If we choose to invest in a mid cap, VIMAX looks like the better choice.”

Bond Funds: Generally Expect Low Risk and Low Return

Lydia and I hadn’t considered bond funds. The reason was simple. Their cash was among the lowest in the lineup. The largest expected NR$ was HWHAX at $553,119, but it had a significant downside for a bond fund, relatively high risk and high cost.

Lydia started the analysis, “None of these jumps out as a great choice.

	CASH (NR$)	C$	s	C$/NR$
DODIX	$190,230	$43,076	1.0%	27.4%
VBTLX	$148,093	$20,417	0.9%	15.9%
HWHAX	$553,119	$249,817	6.0%	50.5%
BPRIX	$128,008	$26,058	1.9%	23.0%

“HWHAX has the largest expected cash and the highest expected risk. DODIX’s has a much lower risk but also much lower expected cash. Not far behind DODIX is VBTLX and BPRIX.

“While I’m inclined to include a bond fund, I’m not confident about the choices we have. They’re supposed to move in the opposite direction of equity funds, which is good for diversification. That should help reduce our overall market risk. But which bond fund?

The best among them, HWHAX, doesn't seem reduce overall risk. I just don't understand why any bond fund would bounce around that much. It has among the highest standard deviation of any of our funds." Lydia paused. "I'm going to have to think about this."

I offered an alternative. "Balanced funds include stocks and bonds. DODBX has twice the expected cash of HWHAX with less risk. DODBX may be enough bond diversification for me."

"That's an interesting idea."

Lydia, like Grandma, offers few compliments. I have to admit, I felt pretty good.

Our Weakest Category: Foreign Funds

Our foreign funds had a lot in common with the bond funds. I wasn't very happy with any of them. "Why invest with little or no expectation of returns regardless of their potential for diversification?

"Look at these! It concerns me because the U.S. stock market has gone almost straight up for the past decade, but these funds haven't kept pace. Not even close. I would like to include a foreign fund, but these are very poor performers."

	CASH	C$	s	C$/NR$
RERGX	$124,519.	$33,668	3.4%	27.0%
VREMX	$91,512.	$40,318	2.0%	44.1%

Lydia was troubled, too. "There has to be an explanation."

I wondered what companies they owned. I picked the first one on our list, did a quick internet search, and read what I found to Lydia. "RERGX invests in some well known companies, like Samsung, British American Tobacco, Nestle, and Sony.[48]

“These are profitable companies. Why is RERGX’s performance so low? It seems RERGX’s managers have had enough time to prove their stock picking expertise.”

Lydia asked the zinger: “Did RERGX identify all the companies it invests in?”

I thought for a second. “No, they didn’t. RERGX offered the names of only a few of its investments.”

“The ones they didn’t list may explain the poor performance.”

“Yeah. Come to think of it, they’re managed funds. They probably think they would reveal their investment strategy if they list all their investments. Of course, it also hides their mistakes. When so much information is secret, it’s hard to make any evaluation.”

“You’re right. The fact is our foreign and bond funds are disappointing.”

Oops, one more!

Just to make sure we evaluated all the mutual funds in our lineup, Lydia and I checked off each fund in *THE DATA*. At the very bottom, we found one more. Goldman Sachs Stable Value CIT I, GSSVI. Goldman Sachs offered the following description of GSSVI on its website:

“Investment Objective & Strategy. (The “Fund”) seeks to earn current income and preserve capital and stability of principal. The Fund also seeks to maintain a stable value of $1.00 per Unit.”

“Looks like it’s meant primarily to preserve capital. A dollar today will be worth a dollar tomorrow, but it won’t earn much, if any, return. So, why would anyone want to put money in it?”

“GSSVI gives some assurance that I won’t lose money if the market drops. But it won’t make any money if the market is going up. I look at GSSVI as a place to hold cash in the short term. If I think the market is about to drop, I could sell and lock in my gains. With the cash, if I see an opportunity, I could buy in quickly.”

“It’s like Grandma said about “buy low, sell high. I bet that’s easier said than done.”

“You’re absolutely right! I’m not going to buy and sell every day, looking to make a few pennies every time the market moves. But that won’t keep me from watching the market. I also plan to use our self-directed brokerage account so I can buy and sell stocks of individual companies and other types of investments not included in our 401(k).”

“Self-directed brokerage account?” I took a quick look at *THE DATA*. “I don’t see it listed on our lineup.”

“It isn’t there. It’s an add-on that you have to request.

“I’ve been getting ready to take more responsibility for my financial future. TV offers *Bloomberg*, *Fox Business*, and *CNBC, among others*. I subscribe to *The Wall Street Journal*. There’s lots of business news on the internet. The experts don’t agree and they’re wrong at least as often as they are right. It’s a lot like what we’re doing here. We have to sort through the information and make the best decisions we can.”

“Although Grandma wants us to learn on our own, she’s willing to point us in the right direction. We’re at a point where we’ve done a lot of work and need some idea where to go next. There’s so much information and so many directions we could go. It’s a good time to call Grandma.”

Lydia agreed but when we reviewed our notes, we realized they were far too complicated to discuss over the phone. Foremost among our questions were: Are we identifying the best investments from our lineup? Is a self-directed brokerage account a good way to

build security for retirement? Are we missing anything? We organized our ideas in an email and asked Grandma for an audience.

“Are we missing anything?”

Grandma Combs got back to us as soon as she could. The end of the semester meant grading exams and papers. When she called, she got right to the point. “I was very pleased that Lydia and you recognize the purpose and limitations of making predictions decades into the future. Your email used the word, “expected,” many times. In other words, the costs and returns you used would *roughly* approximate future dollars. You also plan to reassess your investments from time to time. That tells me you understand the primary message in prospectuses and the small print in advertisements: *Past performance is no guarantee of future performance*.

“I’m scheduled to give a paper at The Business Association. I’ll leave tonight, so I’ll offer some ideas rather quickly.

“Given your lineup of funds and relevant data, your reasoning and conclusions seem sound to me. Of course, there are no guarantees. For example, if I, like you, were to diversify with a small cap fund, I clearly would go with VSMAX over the alternatives, DHSIX and ACWDX. A couple of the categories contain closer calls in terms of cash, risk, and cost. That means you need to make some personal assessments.

“Lydia seems prepared to consider investing beyond mutual funds. Her stable dollar fund describes a potential hedge against major market corrections. Some experts claim the stock market is due for a correction. Depending on the expert, it could be between a ten to fifty percent decline. According to them the market is overvalued and low interest rates are keeping stock prices artificially high. If history’s any indicator, when interest rates increase, the stock market is likely to drop. Lydia’s idea to buy individual stocks during a downturn could pay off handsomely.

“Other experts are convinced we’re poised for further stock market increases. If the market continues to climb, a stable dollar fund provides very little return. Regardless, Lydia doesn’t plan to have much invested in a stable dollar fund. She seems prepared to cope with volatility without putting much of her retirement money at risk.

“I like your use of spreadsheets. They allow efficient, flexible analysis, but if I’m following you correctly, you’ve missed taxes and inflation. They’ll significantly reduce your expected cash. Once you’ve determined the effect of taxes and inflation, ask yourselves, are you saving enough for your retirement? You’ll need to budget to answer that question. Estimate cash inflows and outflows while working. Know what you can invest while meeting current obligations. Then, estimate your cash inflows and outflows after you retire. It’s important to know whether you can maintain your standard of living.

“Lastly, a mystery: What’s your all-time best investment?

“I’ll be back next week. Call me if you have questions.”

Taxes and Inflation

Lydia shook her head. “How could I have forgotten taxes and inflation?”

We immediately got to both problems. Taxes first. We assumed retirement income would be subject to less tax because we’d have less income to tax. That, of course, may not be true. Anyway, we settled on a federal tax rate of 20% and an additional state and local tax rate of 5% for a total estimated tax of 25%. That meant for every dollar we saved in a 401(k), governments were going to take twenty-five cents, leaving us with seventy-five cents after taxes.

Our *after*-tax rate was expected to be 75% or .75.

We continued testing new ideas on ARTMX.

Its after-tax cash is .75 x $202,885 = $152,164.

The calculation of after-tax cash the long way was:

.25 x $202,885 = $50,721;
$202,885 - $50,721 = $152,164.

Sidebar: Some states including Florida and Texas do not have individual income taxes. Other states, such as Mississippi, do not tax retirement income. Confirm your state and local tax rates.

Adjusting ARTMX's after-tax cash of $152,164 for *inflation* took some thought.

Over time inflation increases the cost of things we purchase: groceries, gasoline, clothes, among others. That means we will need more dollars to purchase the same things. Another way of saying it is that a dollar will buy less in the future.

Lydia understood that estimating inflation is not an exact science but she found a handy shortcut to estimate it. "The rule of 72 says that if inflation is N% / year, prices will double in *approximately* 72 / N years. For example, at 3% inflation, prices will double in 24 years, (72 / 3). At 2%, prices will double in 36 years, (72 / 2)."[49]

We assumed a 2% inflation rate. The purchasing power of after-tax cash for ARTMX would be about half, or 50%, of $152,164.

50% x $152,164 = $76,082.

In other words, cash after taxes and inflation would buy only $76,082 worth of goods or services in 30 to 40 years. The result was, to say the least, sobering.

Sidebar: Wages may also experience inflation. If participants increase their contributions over time as wages increase, their retirement assets may keep pace with inflation.

Although Lydia and I might not know exact tax or inflation rates, there is little doubt they were going to take a big bite out of our retirement cash. ARTMX might not even return the current purchasing power of the original $91,200 investment.

I wondered aloud, “If my investments aren’t expected to do much better than ARTMX, why bother saving for retirement?”

“Let’s find out. A quick look at RD3, column O, shows eight mutual funds with at least double the cash of ARTMX. We’ll have a better idea after we run the numbers.”

Colleagues had noticed us working during our lunch breaks. They began asking questions, which slowed us down. Several wanted copies of the spreadsheets. Before we realized it, we were holding class. *There’s no better way to learn a subject than to use it and teach it.* I got that idea from Grandma, of course. Anyway, this seemed like a good place to break for the day.

CHAPTER 4
Individual's Choices

Time To Test Our Spreadsheets

It made sense to follow through with my investment choices first, since we used my circumstances to construct RD3. It shouldn't take long. I was confident which mutual funds to invest in and why. Especially interesting was to see the estimated amount of after-tax, after-inflation cash. Lydia was just as interested to get her estimate. Modifying the spreadsheet to accommodate Lydia's investment assumptions seemed a good way to test its versatility. The really good news was the spreadsheets do the calculations.

I've only been on the planet for 26 years. Yet, I understood how much things like technology changed the world in a relatively short time. Who knew what changes would come in 20, 30 or even 40 years? A similar problem plagued investing for retirement. *Uncertainty.*

Whether we invested in one mutual fund and held it or invested in several mutual funds and held them, the returns and costs we estimated would give us an idea of how much money we would have when we retire. As we revisit our investments from time to time and get closer to retirement, our numbers should become more accurate. In other words, everything, including our retirement plans, is subject to change and reevaluation. That is the nature of predicting and planning for the future whether it's changes in technology, future demand for a company's products, or your mutual fund returns. Just think of it, the DOW, which reported the biggest companies for more than 100 years now includes none of the companies from its original list. It's humbling to think about. All those great companies are no longer great companies. I expect to retire in 40 years, so it's hard to imagine the changes between now and then.

My Cash in 40 Years

Time for me to make specific investment choices with our *five rules of thumb*. I took Lydia through my decisions one at a time beginning with an overview.

I began by saving RD3 as RD4.

RD4.xlsx

We had previously input the information in columns A through S, which are the basis for decisions. My investment choices and their expected outcomes are set out in columns T through X.

We had six categories of funds and I wanted to put some of my annual investment in most of them. Lydia made a great argument that diversity is an important investment strategy. The bottom-line? *A portfolio of investments that includes a broad range of segments of the economy—domestic and foreign—has the best chance to provide for my future retirement.*

The amount I allocated to each fund was heavily weighted in favor of the expected highest performers. I was keenly aware that my expectations were a function of historical data.

Column T identifies the amount I plan to invest in each mutual fund. All my individual investments totaled to my annual investment of $2,280 in cell T31. Column U is the expected future value of each annual investment. For example, VFIAX was my large cap equity investment with NR$ of $247,693 (U5). It is the future value of investing $570 per year (T5) for 40 years (I5) at an NRR of .099325 (M5).

The total future value of my investments, NR$ (CASH), is expected to be $1,037,189 (U31), which is the sum of U5, U11, U14, U18, and U23. Column V reports my

investments for each choice over the 40 years and totals to $91,200 (V31). It is confirmation that I've invested the full amount of planned future contributions.

The Decisions One at a Time

VSMAX, a small cap index fund, had the best expected cash at $1,481,197 in O14. Its $1,481,197 is the expected amount *if* I invested all $2,280 for 40 years in VSMAX.

Sidebar: As a reminder, we applied the same retirement assumptions to each mutual fund to identify the best performers. Then we used that information to choose our investments.

The other small cap funds reported similar or higher risk measures, which favored the higher returns of VSMAX. Because I was many years from retirement, I wasn't overly concerned with VSMAX's volatility. I had plenty of time to outlast future downturns. I put $570 in T14, representing 25% of my total expected annual investment (25% x $2,280). VSMAX's future value to me is $370,299 (U14), assuming my investment of $570 each year for 40 years (I14) at an expected rate of return of .114 (M14).

The next best cash performance was VFIAX, a large cap index fund. I allocated $570 to it in T5. Its future value was expected to be $247,693 (U5), assuming an investment of $570 each year for 40 years (I5) at an expected rate of return of .099325 (M5). Although I could have invested in more than one large cap fund, VFIAX nicely covered the large cap market.

I also chose a balanced fund, DODBX. Its future value is expected to be $229,898 (U18), assuming an investment of $570 (T18) each year for 40 years (I18) at an expected rate of return of .096575 (M18).

VIMAX was my choice for a mid cap equity fund. Its future value was expected to be $133,987 (U11), assuming my investment of $342 (T11) per year for 40 years (I11) at an expected rate of return of .0955 (M11).

I'm willing to take a few risks and my selection of a bond fund shows it. HWHAX is the best performer among bond funds. It has the highest risk measure by far and its cost percentage almost doubles the next largest bond fund. However, HWHAX is an example of higher reward coming with higher risk. On balance, this was a harder decision than the others. Given my risk tolerance, I've decided to annually invest $228 (T23), a mere 10% of my annual contributions. Its future value to me, assuming my investment of $228 each year for 40 years (I23) at an expected rate of return of .0775 (M23), is $55,312 (U23).

Our available foreign funds had such low returns I didn't invest in any of them. We again wondered, why such poor performers are included in our lineup of funds? Lydia questioned whether it was just these funds or whether foreign funds generally had lower returns. We didn't know but it was a good question to ask the folks at NBIS.

Lydia reminded me, "If you change your mind about foreign funds or any of your investments for that matter, you can reallocate at any time. The spreadsheet will quickly recalculate all the results."

Lydia and I took a few minutes to study RD4. We had enough information to estimate how much cash my annual investments would produce when I was ready to retire. I began to add the expected future values in column U, my CASH, with a handheld calculator.

Lydia stopped me. "Let the spreadsheet calculate it."

I looked up from my calculator and said, "Yeah, you're right." I had to change my way of thinking. I needed to work smarter. The spreadsheets were up and running, thanks mostly to Lydia's skills. Might just as well continue to put them to good use. In cell U31, I proudly and a bit nervously typed =(U5+U11+U14+U18+U23). Uncertain of my spreadsheet skills I punched the number into my handheld calculator, too. Either way my CASH expected at the end of 40 years was $1,037,189.

“Pretty impressive!”

Lydia quickly tempered my enthusiasm. “Seems like a lot. Let’s consider the effects of taxes and inflation.”

“Party pooper.”

She smiled and continued, “We assumed a federal tax rate of 20% and an additional state and local tax rate of 5% for a total estimated tax of 25% during retirement years.

“Keep in mind that the after-tax rate is 75% or .75.”

We first used our handheld calculator to figure after-tax CASH.

After-tax CASH = (.75 x $1,031,364) = $777,891.

Then added a spreadsheet formula to cell U33. The spreadsheet formula is =.75*U31. It gave us the same answer.

We assumed inflation would be approximately 50%. My after-tax cash of $777,891 adjusted for inflation equaled $388,946 (U33):

After-inflation CASH = .50 x $777,891 = $388,946.

Click on U34 to see the spreadsheet formula, =.5*U33.

“Still not too bad.”

Lydia brought me back down to earth, again. “Realistically, how much cash can you take each month and not run out of money?”

“I have no idea.”

“We need some notion of life expectancy.”

“You’re asking how long I’ll live? The measures we’ve been estimating are uncertain enough. *Now, how long will I live?* What-if doesn’t seem like a game anymore. Most definitely not fun. When I think about all the complications, I feel like throwing up my hands and quitting.”

Lydia let me rant, but not for long. “We’re coping with an uncertain future. The key is to make well-reasoned choices with the information we have today. A good plan today is better than a perfect plan tomorrow. Certainly better than no plan at all. Maybe most important, we’ll revisit our decisions and improve on them from time to time.”

It was good advice. I took a deep breath and in a few seconds got back to estimating life expectancy.

We searched the internet and found several articles that recommended similar strategies.[50] Most suggested withdrawing 4% per year, which implies my CASH would last 25 years (100% / 4%). That works out to 300 months (25 years x 12 months per year = 300 months).

“We can always rethink the 4% when we review our investments.”

In U35, I typed =U34/300. On a per month basis, after-tax and after inflation CASH is expected to be $1,296.

Sidebar: Play with the numbers. For example, *what if* you withdraw at a rate of 5%, which means a 20-year period (240 months), how much would you have to spend per month? The spreadsheet will quickly provide the results.

“So, after taxes and inflation, on a per month basis, I can expect to have about $1,296. When you look at the details, $1,037,189 gets whittled down pretty quickly.”

“Don’t lose heart, you haven’t included Social Security, yet. With a little luck and a lot of hard work, you’ll make and save more and have other investments and assets to help support yourself.”

“I hope.”

“Do more than hope. We need to put all this in perspective. What are our expected cash inflows compared with expected cash outflows? In short, how much money will we need to maintain a comfortable standard of living? Cash inflows from our 401(k)s, social security, and any other expected source of income needs to be compared with expected cash outflows. In a word, budgeting! It will give us a perspective on our financial future. Will a monthly withdrawal of $1,296 plus Social Security be enough to support you?”

“Before we take on budgeting, Lydia, let’s do your investment choices. I need to see how our ideas work for you, too.”

“Okay. But I have a confession. WorldCom is still nipping at my heels. I haven’t forgotten how much money I lost. I’ll be cautious but hopefully not too much.”

Lydia’s Turn

Lydia could have created a completely new spreadsheet. Instead, She saved RD4 as RD5.

RD5.xlsx

“Cells A1 through A3 now show my retirement assumptions: (1) annual contributions of $4,000 which included the employer’s matching contribution, (2) rollover of $100,000 from a previous 401(k), and (3) retirement in 20 years.”

Sidebar: Lydia's spreadsheet is a blueprint of how you might use a spreadsheet like RD5. You may have (1) continuing annual contributions, (2) assets you've accumulated to date, and (3) an estimated number of years until retirement. Your annual contributions going forward could be the same as in the past or changed, hopefully increased. The amount of your current assets, which is the total amount of previous contributions and earnings, is similar to Lydia's "rollover" from another 401(k).

Lydia continued, "The tickers in column A and the return, expense, and fee ratios in columns B through G are from *THE DATA*. I inserted a new column, H, and labeled it 'One-Time Rollover,' my 401(k) assets I saved working at another job. I've included $90,000 in each row of column H."

"Wait a second. You put the wrong amount in the rollover column. Shouldn't it be $100,000?"

"I'll explain in a few minutes. Let me finish my changes to RD5."

"Yes, ma'am."

"To see what I'm going to say next, it may be helpful to have RD4 and RD5 side-by-side."

I pulled up both spreadsheets. "Ready."

"I created the new column, H, by highlighting column H and clicking on 'insert,' which is under the 'cell' function. The spreadsheet automatically shifted the later columns to the right. Old column H is now column I, old column I is now column J, and so on across the columns. I changed the cells in columns I and J to reflect my investment assumptions. Column K multiplies columns I and J and adds column H. Columns L, M, and N in RD5 are the same as columns K, L, and M in RD4.

“Future values in dollars were calculated in columns O through T. The major difference is your spreadsheet, RD4, used a formula to calculate the future value of annual contributions. My spreadsheet, RD5, uses formulas to calculate the future value of my annual contributions *and* the future value of my rollover.”

Aaron wrote out the formulas as a review. Each time they used them he became more familiar with the math.

> The future value formula of a single amount, like a rollover, is:
>
> Rollover x $(1 + r)^n$ or Asset Amount x $(1 + r)^n$
> See, columns P and S. The computer version of this formula is embedded in P5 and S5 for VFIAX.
>
> The future value formula of annual contributions is:
>
> Annual contribution x $(((1 + r)^n – 1) / r)$
> See, columns O and R. The computer version of this formula is embedded in O5 and R5 for VFIAX.

“Columns T (NR$), U (C$), V (STDEV), W (C$/NR$) provide inputs for decisions.”

Lydia started by comparing the mutual funds on the same basis I did: *more cash is better than less*.

“This won’t take long. We’ve done the analysis a couple times, now.”

Lydia’s first selection was VSMAX in the small cap category. It showed the best NR$ cell T14. This was an easy decision. Not only was VSMAX an index fund, it had the second lowest risk measure and lowest cost percentage of the small caps.

The amount she allocated to each fund was also heavily weighted in favor of the expected highest performers. She assigned $1,000 of her $4,000 annual contributions to Z14 and allocated $25,000 of her $90,000 rollover to AA14. VSMAX's future value to Lydia was expected to be $283,818 (AD13), assuming her investment of $1,000 (Z14) per year and a rollover of $25,000 (AA14) both at an expected rate of return of .114 (N14) for 20 years (J14).

VFIAX had the next best NR$ with $825,439 (T5). Although VFIAX edged out MEIKX with a slightly better expected risk measure and cost percentage, what tipped the balance in favor of VFIAX was that it was an index fund whereas MEIKX was a managed fund with a cost almost twice VFIAX's.

Lydia left little doubt what she thought about the future of managed funds. Since she worked in personnel, she was well aware of the costs associated with labor, professional or otherwise. "If anything, I expect their costs to go up."

She assigned $1,000 from her annual contributions to VFIAX (Z5) and allocated $25,000 from her rollover to it (AA5). VFIAX's future value to Lydia was expected to be $222,973 (AD5), assuming her investment of $1,000 per year and a rollover of $25,000 both with an expected rate of return at .099325 (N5) for 20 years (J5).

DODBX was Lydia's next choice. She assigned it $750 (Z18) of her annual contributions and allocated it $17,500 (AA18) from her rollover. DODBX's future value was expected to be $151,933 (AD18), assuming her investments earn a rate of return of .096575 (N18) for 20 years (J18).

VIMAX also seemed worthwhile. She assigned it $750 (Z11) from annual contributions and allocated $17,500 (AA11) from the rollover. VIMAX's future value to Lydia was expected to be $149,286 (AD11), assuming her investments earn a rate of return at .0955 (N11) for 20 years (J11).

Our lineup of bond funds was as troubling for Lydia as it was for me. Lydia wasn't sure which one she should invest her remaining $500 from annual contributions and $5,000 from rollover. (She had already decided not to invest in foreign funds.)

I blurted, "Who's to say you can't put a little in two or more of them?"

She frowned at me. It was a frown from deep thought, because she soon smiled. "Of course."

Lydia chose to invest half in VBTLX and half in HWHAX. She assigned each $250 (Z22 and Z23) from her annual contributions and allocated each $2,500 (AA22 and AA23) from her rollover. Their future values were expected to be $22,253 (AD 23) from HWHAX and $10,244 (AD22) from VBTLX.

We agreed about investing in foreign equity funds. Our money could be more profitably invested elsewhere. As we had evaluated the funds in our lineup, we can to the conclusion that many of them underperformed.

"We may want to talk to our employer about looking for some better funds."

"It couldn't hurt. They use the same 401(k) plan as the rest of us. It stands to reason they may be interested in what we have found."

We wound up investing in many of the same funds. No surprise since we were selecting from the same lineup and picking the best. It was also no surprise I'd have more cash. I was investing for more years and taking advantage of the power of compounding over time. What got our attention was the size of the difference. We took a few minutes to compare spreadsheets.

	Lydia's	Mine
Cash at retirement	$840,508 (AD31)	$1,037,189 (U31)
After-tax	$630,381 (AD33)	$777,891 (U33)
After-inflation	$315,190 (AD34)	$388,946 (U34)
Cash per month at retirement	$1,051 (AD35)	$1,296 (U35)

I could tell Lydia was troubled.

"Something's not quite right."

"I followed your numbers. They seem right. I even think I'm getting the math."

"Our analysis *before* taxes and inflation *overestimated* our cash. Now, we've *underestimated* our cash *during* retirement. My $840,508 and your $1,037,189 continue to earn returns after we retire, which we assume to be 25 years. We're obviously not going to take all our money out on the date we retire. We want to draw it down a little at a time to live on. That means our monthly withdrawals during retirement will be larger than simply taking our total cash at the date of retirement and dividing by 300 months. That's what we did to get cash per month at retirement. That's not right. Here are the numbers."

	Lydia's	Mine
Cash before taxes and inflation	$840,508 (AD31)	$1,037,189 (U31)
Monthly *before* taxes and inflation	$2,802 ($840,508/300)	$3,457 ($1,037,189/300)
Cash after-taxes and inflation	$315,190 (AD34)	$388,946 (U34)
Monthly *after* taxes and inflation	$1,051 ($315,190/300)	$1,296 ($388,946/300)

"See what I mean? Our analysis was incomplete. The $2,802 and $3,457 were overestimates because we hadn't deducted taxes and inflation. And now, the $840,508 and $1,037,189 are underestimates because we haven't included earnings on them while we're retired."

“The math’s got to be complicated.”

“Let’s look for an online calculator that will recognize earnings while taking withdrawals.”

We found a really cool website: “Savings Withdrawal Calculator.” https://financial-calculators.com/withdrawal-savings-calculator. It answered our question, what’s the maximum we can withdraw per month while the principal continues to earn returns? For our purposes, “maximum monthly withdrawal” is the same as the calculator’s phrase “regular withdrawal amount.”

MATH ALERT:
The formula underlying the “Savings Withdrawal Calculator” is:

$$\text{Regular Withdrawal Amount} = (\text{Cash At Retirement} / ((1 - (1 / (1 + r)^{n})) / r))$$

This formula calculates regular withdrawal amounts before taxes and inflation.

The inputs to the “Savings Withdrawal Calculator” using Lydia’s assumptions are:

Savings On Hand (PV) [For us, cash at retirement]:	$841,508
Regular Withdrawal Amount? [The calculator requires input of a zero to solver for the “regular withdrawal amount.”]:	0
Number of Withdrawals (#) [25 years x 12 months per year]:	300
Annual Interest Rate [Rate cash expects to earn]:	5%

The 5% “Annual Interest Rate” is a convenient estimate. It is net of expense and fee ratios. Lydia hit “Calc” (Calculate) and it gave her a “Regular Withdrawal Amount” of $4,936.45.

Sidebar: Lydia and Aaron could run numbers assuming different “Annual Interest Rates.” For example, they could calculate a “regular withdrawal amount” assuming an interest rate of 3%, then do it for 6%. The different interest rates would give them a range of expected maximum monthly withdrawals. A range may provide a better estimate than a single point estimate. The spreadsheet makes the calculations quick and easy.

“We still have to adjust for taxes and inflation.”

After-taxes, the $4,936.45 became $3,702.34.

.75 x $4,936.45 = $3,702.34.

After-inflation, the monthly withdrawal becomes $1,851.17

.50 x $3,702.34 = $1,851.17

Allowing for rounding variations, Lydia’s spreadsheet, RD5—AD38 ($4,913.53) and AD39 ($1,842.57)—confirmed the “Savings Withdrawal Calculator.”

“$1,843 is better than $1,051, but I bet it’s still not enough. Budgeting will help answer that concern.”

“Before we go to budgeting, let’s see how mine turns out.”

Using the “Savings Withdrawal Calculator,” I ran the numbers using my cash, $1,037,189, and came up with a monthly withdrawal of $6,084. On an after-tax, after-

inflation basis, it was $2,282. Spreadsheet RD4 confirmed them: $6,063.30 (U38) and $2,273.74 (U39). Rounding variations explain the minor differences.

We summarized our results.

	Lydia's	Aaron
Cash At Retirement	$840,508 (AD31)	$1,037,189 (U31)
After-Tax, After-Inflation Cash Per Month	$1,843 (AD39)	$2,274 (U39)

"My cash after 20 years is expected to be $840,508 versus your cash after 40 years is expected to be $1,037,189. Your extra 20 years makes a huge difference even though you invest $1,720 per year *less* than I do and you *don't* have a rollover. Even more telling is my expected after-tax, after-inflation cash, $1,843. Yours is $2,274, more than $400 per month more than mine. Another way to look at it, you'll have $4,800 more per year than I will. Right now, that difference is enough to pay the insurance on my house and car and have some left over. Those numbers are, to say the least, sobering."

It was amazing how time made a big difference in expected cash. We thought it might be interesting to see what happens if Lydia invested for 30 years instead of 20. How much difference would an additional 10 years make. Time to play "what-if."

We saved RD5 as RD6 and changed column J from 20 to 30. Spreadsheet RD6 immediately ran the numbers.

Sidebar: Readers don't need to save a new spreadsheet every time they play "what-if." We are doing it so the reader can review the spreadsheets as we are completing them.

RD6.xlsx

“Amazing!”

Lydia’s total expected cash nearly tripled from $840,508 to $2,286,416 (AD31). Her after-tax, after-inflation monthly withdrawal rockets from $1,051 to $2,858 (AD34).

We recalculated the monthly withdrawal of $2,858 to recognize the earnings on $2,286,416 during 25 years of retirement using “Savings Withdrawal Calculator.” https://financial-calculators.com/withdrawal-savings-calculator.

The inputs to the “Savings Withdrawal Calculator” using Lydia’s cash and assumptions were:

Savings On Hand (PV):	$2,286,416.
Regular Withdrawal Amount?	0
Number of Withdrawals:	300
Annual Interest Rate	5%

Lydia hit “Calculate” and it gave her a “Regular Withdrawal Amount” of $13,375. Subject to a rounding variation, RD6 confirmed her pre-tax, pre-inflation withdrawals at $13,366 (AD37).

After-taxes, after inflation, the $13,375 becomes $5,016.

.75 x .50 x $13,375 = $5,016.

So, the additional 10 years increases Lydia’s monthly withdrawals from $1,851 to $5,016.

Sidebar: In RD6, cells AD37 and AD38 report $13,366 and $5,012, respectively. The difference is due to rounding variations produced by the spreadsheet and the "Savings Withdrawal Calculator."

Lydia sighed. "I wish I had 30 more years to work instead of 20, but the clock is against me. I'm afraid $5,012 is wishful thinking. I'm left with the question, is $1,851 per month enough to live on during retirement? Probably not. Since I probably don't have 30 years to invest in my 401(k), I need to figure out how to increase my contributions."

"Looks like we're proving the importance of budgeting."

$10,000

"I almost forgot. I was preoccupied when you asked why I put a rollover amount of $90,000 instead $100,000 in column H. Take a look at RD5, AA32 through AA34. I've not recognized any returns on the $10,000 I've assigned to the Goldman Sachs Stable Value Fund."

"I suspected you were up to something interesting."

"Profitable, not just interesting. I hope. I plan to transfer the $10,000 from the Stable Value fund to a self-directed brokerage account."

"I didn't see it in our lineup and you were going to tell me about it."

"I had to ask for it. Ours costs about $50 per year. Some can cost as much as $500 plus a percent of your account balance. Our employer negotiated a good deal for us."

"You've got plans, I bet."

"Your Grandmother anticipated what I plan to do. I'll park the $10,000 in a money market account. When there's a dip in the market or a buying opportunity, I'll have cash

to buy individual stocks or bonds. I can also buy mutual funds that aren't included in our lineup. Maybe I'll find a good foreign equity fund. Anyway, the $10,000 is a way of saying I'm concerned that the stock market might experience a serious decline. It does periodically. And it's at an all-time high, now."

"$10,000. Why have so much on the sideline?"

"If I had $10,000 in my purse, it would seem like a lot. But it's not so much when you think about it. My total 401(k) investment over the years is expected to be $170,000. $10,000 is a small fraction of my total investment, about 6 percent. Keep in mind I can invest it anytime. Tomorrow, if I see a good investment."

Lydia paused, remembering her WorldCom experience. "What goes up, also goes down. Look again at past recessions. What does the Dow Jones – 100 Year Historical Chart tell us?"

We pulled it up and studied it again. http://www.macrotrends.net/1319/dow-jones-100-year-historical-chart

We don't know when, how much, or for how long it will last. The last significant downturn was about a decade ago. Looking at the chart, the stock market seems overdue for a correction."

"Lot's of uncertainty, to be sure. When I get more confident, I may open a self-directed account, too. If you don't mind, I'll watch what you do with yours."

"Sure. Explaining what I'm doing helps me think through the investments."

Budgets

"Now that we have a notion of how much money we might expect from our 401(k), what should we do next?"

“Let’s put what we’ve learned together with details about other sources of income, like Social Security. We can anticipate costs, too, like medical expenses.”

“Budgeting.”

Chuckling, Lydia said, “Don’t sound so excited.”

CHAPTER 5

Given my investment choices, will I have enough money for a comfortable retirement?

Time to Get Personal!

I had shared Grandma Combs with Lydia. She returned the favor by sharing her budgeting plans. Her first budget plan was expected cash outflows and inflows while she was still working. Her second was cash outflows and inflows after she retires. Comparison of the two should give an idea whether she's saving enough for a comfortable retirement.

Sidebar: Keep in mind your budgets are approximations and very personal. No one can help you with budgeting as much as an honest self-appraisal. Looking over your cash outflows, are there any that can be reduced or eliminated? You know what you spend. You know what you really need. Furthermore, how much do you make? Write it out. Compare cash outflows with cash inflows. Got any extra? (Don't laugh.) If not, is there a way to change your behavior to reduce cash outflows or increase cash inflows to set aside more for retirement? Now is time to think about it. And do it.

Cash Outflows And Inflows During Years Of Employment

"My divorce last year was a sobering event in many ways, providing for my retirement as a single mom among them."

Initially, Lydia used her checkbook and credit card bills to identify how much she spends on mortgage payments, house maintenance, house insurance, utilities, food, car payments, car maintenance, car insurance, gas, health insurance, clothes, computers, cell phones, dentists, doctors, glasses, school expenses for the children, entertainment, etc. Since some costs like insurance on her house and cars are paid once a year, she budgeted for an entire year. It came to about $78,000. Then she put the yearly amount on a monthly basis—about $6,500.

“Phew! I was aware of my costs, but writing them down in detail motivates a whole different perspective.”

Cash inflows were much easier to come by. Her salary was negotiated with her employer. Current cash inflows were approximately $80,000 net of taxes and other deductions. She was left with a $2,000 buffer for emergencies.

She was forthright about her situation: “$2,000 is hardly enough to pick up miscellaneous costs I may have forgotten. More importantly, if I’m to save more for my 401(k), I’ll have to find places to cut back spending.”

We both agreed that we would rather make these hard decisions while we were working rather than discovering we don’t have enough money once we retire.

Cash Outflows and Inflows During Retirement Years

The cash outflows and inflows during retirement were much more difficult to project. Everything, including how long we might live and how much our retirement accounts would grow were estimates. Lydia started by making adjustments to current expenditures, eliminating some costs while increasing others. Clothes and gasoline, for example, were likely to cost less after retirement. However, other costs were likely to increase. Currently, our employer paid most of our health insurance costs, which saved us several thousand dollars every year. I was surprised to find that when we retire, only basic Medicare was “free.” Other Medicare parts—some of which we would be legally required to buy—would be priced according to how much income we had. All in all, estimating how much money we would need to maintain our current standard of living took some time and thought.

We found advice in our search on how to estimate costs during retirement:

> Many financial planners suggest that 80% of your pre-retirement income offers a retirement standard of living that is substantially similar to pre-retirement standard of living.[51]

For Lydia, this meant that she'd need to plan for $64,000 to maintain her current standard of living. ($80,000 x 80%) That translates to approximately $5,300 per month.

Health Costs

Lydia became knowledgeable about health care costs and social security during her professional career at jobs in personnel departments. I'm catching up by studying government and financial websites. Some are quite good like https://www.ssa.gov and https://finance.yahoo.com/news/apos-medicare-part-b-costs-130100889.html.

Health care costs may be a major expense during retirement years. Since our employer paid most of our health insurance premiums as a benefit, health insurance when we retired was going to take a sizeable bite out of savings. Medicare Part A, which is "free," covers inpatient hospital care, only. There is a $1,024 per occurrence deductible. This means if you go into the hospital 5 times in a year you can have up to 5 deductibles ($5,000+). Part A does not include any doctor visits, ER, urgent care, outpatient surgery, or other outpatient services. As for Medicare Part B, which is required, the costs ranged from $187.50 per person per month up to $428.60 per month, depending on income.[52] Part B doesn't cover prescriptions or a lot of other things including deductibles and 20% of total bills. If history is any guide, these costs are only going to go up.

Social Security

Social Security won't be enough to maintain our standard of living. The average Social Security benefit is about $1,300 per month. You may get more or less. That said, the question is, *are Social Security and 401(k) savings enough?*

Sidebar: More than likely you'll receive Social Security benefits. The ***current*** age requirement for full benefits is 66. The Social Security Administration provides an online calculator with which to estimate monthly payments.[53]

As with 401(k) accounts, Social Security will be adversely affected by inflation. Cost of living increases to compensate for inflation are unlikely to be adequate.[54] Social security may be reduced further by Medicare Part B. "Medicare beneficiaries who are on Social Security get their Part B premium deducted from their monthly benefit check. So before you retire, when you get the estimate of your monthly Social Security benefit from the Social Security Administration, it's important to mentally subtract your Part B premium from the total to understand what will really hit your account each month."[55]

Some experts are skeptical about the future ability of our government to pay much in benefits. Financial news often reports about funding shortfalls for Social Security.[56]

Lydia compared her expected costs with her expected cash inflows. Her expected monthly cash outflows came very close to the cash requirement using the 80% rule, approximately $5,300 per month. Based on her current income, with small adjustments for pay raises, her expected cash inflow from Social Security was about $2,400.[57]

Lydia's estimated monthly 401(k) withdrawals adjusted for taxes and inflation was $1,843. See, RD5, cell AD39. The bottom line: she expected to be short by $1,057 per month, which translates to more than $12,000 per year!

$1,843 + $2,400 - $5,300 = -$1,057 per month
-$1,057 x 12 = -$12,684 per year

"That is really worrisome. I need to rethink my 401(k) contributions and maybe even consider working longer, maybe until I'm 70. I can cut back on what I'm spending now. I really don't need to spend $150 a month at a coffee shop. I could save $500 to $600 per

month if I don't buy lunch at work. I'll have to think about where I can reduce spending and add to my 401(k) contributions, but still have a little money for fun things, too."

Sidebar: Make adjustments to RD5 to help Lydia. Assume that she works 25 years instead of 20 years and increases her Investment Per Year from $4,000 to $5,000 per year. What would her after-tax, after-inflation monthly cash be? Would she have income for a comfortable retirement?

She also acknowledged that many circumstances could interfere with her best-laid plans. Two major issues were especially troubling: mortgages and children.

Mortgages

Lydia expects to pay off her mortgage before she retires. If she fails, it will be a significant burden during retirement.

Sidebar: "Older consumers are carrying more mortgage debt into their retirement years than in previous decades. For home owners age 65 and older, the percentage carrying mortgage debt increased from 22 percent to 30 percent from 2001 to 2011. Among those aged 75 and older, the rate more than doubled during that same time period, from 8.4 percent to 21.2 percent…From 2001 to 2011, the median amount older homeowners owed on mortgages increased 82 percent from about $43,300 to $79,000."[58]

Children

Lydia's ex-husband agreed to help pay for their children's college. The kids are smart, so they expect some costs to be offset with scholarships. That was more hope than a plan. Regardless, they didn't want their children burdened with school loans. So, both of them regularly pay into a dedicated savings account for their education. Borrowing or co-signing for school loans is something she wants to avoid.

Sidebar: Lydia couldn't help but think about how plans can be upset. She doesn't have to sign for school loans. That's a personal decision. If she chooses to, and the children

default or can't pay, she is on the hook. If her two children each borrow $30,000 (which is pretty modest), she could be responsible for $60,000. What if she had to pull that money out of her retirement account? What if the kids graduate from college and can't find jobs? What if they failed to graduate and still incurred the debt? These are all uncertainties that she has to consider.

I wasn't hamstrung with familial obligations or a mortgage. Not yet, anyway. I wasn't afraid of debt, but I should have been. For me, ignorance was bliss.

CHAPTER 6

"Hands Down The Best Investment: Pay off Debt!"

An 18 Year Old

While we were on the subject of debt, its opposite, paying off debt, was a financial strategy hiding in plain sight. I had a pretty good idea what Grandma Combs was getting at when she asked: What is the best investment?

When I was about to borrow money for college, Grandma asked if I had any idea what that debt would cost? I thought she meant the cost of tuition, books, fees, and room and board. She didn't. She was asking about the cost of money. I was totally focused on the hype—*education is a great investment*—and the up-front, well-publicized costs like tuition.

It was easy to get a student loan. I could have the money now, enjoy college, and pay it back sometime in the gauzy distant future. I didn't have to think about paying the money back until 9 months after I left college. As an 18 year old, four years and nine months was the same as never. So, I felt comfortable ignoring Grandma's question. I currently owe on a student loan and still don't know how much the borrowed money costs.

I asked Lydia, "What do you think of Grandma's 'best' investment?"

Like Grandma, Lydia was very practical in her reasoning. She opened a document on her computer and showed me the total cost of her mortgage. The loan was $250,000 for 30 years at a 4.5% interest rate. The details, especially the total interest cost, were…well, take a look at what she showed me.

"I'll walk you through the math. It's a good review.

"First, the interest rate per year is .045.

“Second, interest is compounded monthly, which is .045 divided by 12 months equals .00375. A .045 annual interest rate is a .00375 monthly interest rate.

“Third, the monthly payments span 30 years, or 360 payments; 30 years times 12 months per year or a total of 360 months of payments.

“Fourth—I’ll write this one out in two steps—the monthly mortgage payment is:”

$$\text{(a) } [1 - (1 / (1.00375)^{360})] / .00375 = 197.3611590$$

$$\text{(b) } \$250{,}000 / 197.3611590 = \$1{,}266.71.$$

I immediately googled *loan calculator or mortgage calculator.* It produced a multitude of hits that do the math. I used https://www.bankrate.com/calculators/mortgages/loan-calculator.aspx.

I input $250,000 in the blank for “Loan amount;” 30 in “Loan term of years;” 4.5 in “Interest rate per year;” and clicked on “calculate.”

It quickly answered:
$1,266.71 as the “Monthly Payment”
$250,000 as the “Total Principal Paid,” and
$206,016.78 as the “Total Interest Paid.”

I turned my computer to show Lydia. “Okay, I got the same monthly payment, $1,266.71. But how did the calculator come up with “Total Interest Paid.” That seems like a really important number. Outrageous, too.”

“Outrageous is right. But, it’s just the flip side of the return on our investments. Small numbers over a long time turn into big dollars. The monthly payment on the mortgage is $1,266.71.

“Total payback is the $1,266.71 payment per month times 360 months or $456,016.78, principal plus interest.

“Total interest, the cost of the loan, is $456,016.78 less $250,000 or $206,016.78. That is the cost of using the bank’s money.”

“*WOW!”* Even though I had a pretty good idea that interest cost on a mortgage would be a lot, the magnitude was still a *WOW!* moment.

Lydia finished what she learned about the cost of her home mortgage by showing me the calculation of interest as a percentage of the mortgage:

$206,016.78 / $250,000 = 82%.

“The interest cost alone is nearly as much as the cost of the home itself!”

Sidebar: With each payment, the portion paying down the principal gets a little bit bigger, and the portion going to interest gets a little bit smaller. Here’s how it works: Each payment, $1,266.71, includes interest on the unpaid balance of the loan, which is highest during the early years. For example, the first payment’s interest cost is: ($250,000) (.00375) = **$937.50**.

The difference between the monthly payment and monthly interest cost goes to lower the principal amount. So, the amount that goes toward paying the principal on the first payment was: $1,266.71 - $937.50 = **$329.21**.

If Lydia sold her house during the first few years of the mortgage, she would have paid very little on the house. If she keeps the house for the full 30 years, the payback and interest cost were shockers, $456,016.78 and $206,016.78, respectively.

Sidebar: A tax deduction will reduce the interest cost on a mortgage. However, about half of the people who have mortgages don't get an interest deduction. There are many misconceptions about mortgage interest tax deductions.[59]

Before me moved on, I ran a few numbers all by myself—with Lydia watching, of course. I had all the details to calculate the cost of my school loan. The WOW! was on me this time. I learned something else. If I paid more than the monthly payment, that entire extra amount went to reduce the principal. I'm ready to pay off the loan as quickly as possible and avoid a lot of the interest cost.

Lydia: "It can always get worse."

"Credit card debt is even worse than a mortgage or school loan. Its interest rate may be as low as 12% or as high as 24%, depending on your credit rating. Some people never pay off their credit cards. It can become a permanent and huge interest cost.

Sidebar: The average U.S. household owes $16,061 in credit card debt, up from $14,546 from 2006, according to an analysis released by a personal finance company, NerdWallet. Dec 20, 2016.[60]

"Let's see just how bad it is."

We ran the numbers assuming the borrower kept an average running balance of $10,000 for 25 years (300 months) with a 12% interest rate.

MATH ALERT

1. Interest rate per year: .12 (i.e., 12%)

2. Interest is compounded monthly: .12 / 12 = .01 interest rate per month

3. Number of months: 25 years (12 months) = 300 months of payments

4. Credit card payment per month:

(a) $((1 - (1 / (1 + .01)^{300})) / .01) = 94.94655125$

(b) $10,000 / 94.94655125 = $105.32

My "Loan Calculator" did the monthly payment quicker than Lydia did it by hand: $105.32.

Total principal plus interest is $31,596.72. (($105.32 x 300)

Total interest cost is $21,596.72. ($31,596.72 - $10,000)

Total interest as a percent of credit card debt is 215%. ($21,596.72 / $10,000)

I shook my head. "The interest cost is more than twice the amount borrowed! Borrow $10,000 and pay back $31,597. I wonder how many people understand what's happening to them?"

"It gets worse," Lydia said again without humor. "The cost of credit card debt isn't an either-or proposition, either credit card debt or no debt. Many people have mortgages, student loans, car payments, and all sorts of other types of purchases on credit. I bet people don't know what their total debt costs them.

"I think your Grandmother is right. Our best investment is paying off debt. A comparison of our mutual fund returns with debt provides an interesting perspective. ***There is not a single fund on our list that has as much as a ten year 12% return.*** It's not just the amount of interest on your debt that gets you. It's the certainty of the interest rate on debt. When we take out a loan, we enter into a contract promising to pay back a specified interest rate. Sometimes the rates are adjustable, but in my experience they adjust upwards. There's no such contract guaranteeing returns on mutual funds. They can even

be negative. As we've learned, there's much uncertainty—variability—of the rates of return on mutual funds."

Sidebar: It can get worse. A student buys a pizza for **$12** and puts it on his credit card. He just got the card in a promotion to freshmen students. It has the university logo on it. He was impressed and proud to be a student at State U. He's still a child and doesn't know to ask how much the university gets paid for their logo and sales services. Whether he knows it, he pays for that, too. Anyway, how much does the pizza cost him?

$86.47

Payment per month: $12(.015) / (1 – (1 + .015)$^{-480}$) = .18014188
Total cost of pizza, cost plus interest: 480 payments (.18014188) = **$86.47**

His **$12** pizza ends up costing him **$86.47**. The assumptions may be a bit extreme (40 years at 18%), but if he is one of the many people who keep a large running balance on his credit card, the cost of that pizza is a lot more than it appears to be when purchased at $12. Take time to run the cost using an interest rate and number of periods of your choice. The point is debt is very expensive.

401(k): Take Control – Concluding Comments

Our employer-sponsor, Lydia believed, may not know what we had learned. Since they were spending a lot of time and money to provide us with a retirement plan, Lydia thought it was a good bet they wanted to act in our best interests. So we planned to take our analysis of the expensive, poor performers to them and ask that they get an explanation from NBIS. Maybe change out the expensive managed funds for excellent inexpensive index funds. It was a good bet our employer would be interested in improving our investment opportunities, too, because they were investing in the same lineup of mutual funds.

Implied Wages Earned When Rejecting Professional Financial Advice

I was lucky to have Grandma Combs and Lydia help me through the 401(k) maze. With their help, I chose my own investments, rather than pay for professional help, and am confident they're good decisions.

When Ms. Tilson handed out *THE DATA*—a single page of 400+ ratios—the first thing I felt like doing was screaming, *HELP!* I thought I needed professional help until I talked to Lydia. I didn't consider the cost of advice either, but if I had, I would have naively believed it was free.

I also have a life and my preference would not have been to take the time to learn finance. But learning really didn't take long. And it occurs to me that diversification has broader implications than investing and finance. The more skills I acquire, that is, diversifying my portfolio of abilities, including investing and finance knowledge, the better my employment opportunities and quality of life. That insight made me feel pretty smart. Now, I have to continue to work on it. For example, I'm determined to learn the math Lydia used to run our numbers and construct our spreadsheets. It's like learning a different language, but I'm doing it.

So, true to my word, there's no time like the present to put math into practice by answering the question, How much money did I save by learning basic investing instead of paying for professional advice?

If I had decided to pay for help, in addition to the mutual fund costs we calculated using expense and fee ratios, I would have been charged a percentage of my assets as an annual fee. Even itty-bitty numbers could total tens of thousands of dollars. Add to that I would have had little if any control over my money.

Cost of Advice—The Math

Here's a perspective of the cost of advice. Let's say the advisor charges 1.5% of a participant's account balance, about mid-range as such costs go. The balance is $250,000. The advisor's fee is, therefore, $3,750 ($250,000 x .015) *the first year*, taken directly out of my account, probably a little at a time. Let's say instead I decide to learn how to make my investment choices and spend 10 hours the first year doing so. *I'm in effect paying myself $375 per hour.* And that's just the first year. If you don't cancel the service, the advisor's fees may continue every year. The amount you are paying yourself to learn how to invest your 401(k) contributions increases with every passing year. As you gain more experience and knowledge, the less time you need to spend on monitoring investments.

We're not all alike with regard to how much knowledge we have to begin with, the amount of assets in your account, or the fees advisors might charge, so let's develop a range asset balances, fees, and time to learn to get an idea of the potential opportunity wages we might earn.

The following matrix shows the opportunity hourly wages, given (1) mutual fund balances ranging from $50,000 to $500,000, (2) advisory fees ranging from .5% to 2.5%, and (3) hours to learn to invest on your own ranging from 10 to 20 hours. The opportunity wages range from $12.50 per hour to $1,250 per hour.

Mutual Fund Assets	$50,000	$100,000	$250,000	$500,000
Advisor Fees				
0.50%	$250.00	$500.00	$1,250.00	$2,500.00
1%	$500.00	$1,000.00	$2,500	$5,000
1.50%	$750.00	$1,500.00	$3,750.00	$7,500.00
2%	$1,000.00	$2,000.00	$5,000	$10,000
2.50%	$1,250.00	$2,500.00	$6,250.00	$12,500.00
10 hours (e.g.,				
$250/10 = $25)	$25.00	$50.00	$125.00	$250.00
	$50.00	$100.00	$250.00	$500.00
	$75.00	$150.00	$375.00	$750.00
	$100.00	$200.00	$500.00	$1,000.00
	$125.00	$250.00	$625.00	$1,250.00
20 hours	$12.50	$25.00	$62.50	$125.00
	$25.00	$50.00	$125.00	$250.00
	$37.50	$75.00	$187.50	$375.00
	$50.00	$100.00	$250.00	$500.00
	$62.50	$125.00	$312.50	$625.00

Bear in mind, you are not being asked to make decisions about the universe of investments, just the funds that are part of your plan's lineup. That fact makes it practical to make decisions on your own.

I've also found that finance can be interesting—an avocation for me, now. Knowledge has an additional important advantage, because ***no one has more interest in preserving and growing my money for me than I do***. So, I've become better educated. I read the financial press and watch business news on television. I web-search terms and phrases I don't understand. I apply my knowledge to all sorts of things from buying a house to investing in individual stocks and bonds and developing my own diversified portfolio through a self-directed brokerage account. What I don't pay 401(k) providers, mutual fund administrators, and advisors, I get to keep, making my retirement investments more profitable. As I learn, I feel secure investing my 401(k) money.

Take Control!

I'll continue to work with Lydia and Grandma Combs. They each recommended, but in slightly different words, and I'm paraphrasing them, "Let's revisit our decisions, maybe more often than quarterly."

"Yes, ma'ams."

I have taken control of my 401(k)!

End

Simple Advice

Hire a personal investment advisor and pay them thousand, maybe hundreds of thousands over your lifetime.

OR

Invest in index funds. Allocate your money equally among index funds: large cap, mid cap, small cap, balanced, bond, and foreign.

OR

Invest all your money in an index retirement date fund and forget about it.

OR

Invest in Yourself

Make an investment of time to learn how to make money for retirement. An introduction is “401(k): Take Control.”

No one has more interest in preserving and growing your money for you than you do.

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If you're in 1 of these 5 groups, here's what you'll pay:

If your yearly income in 2016 (for what you pay in 2018) was			**You pay each month (in 2018)**
File individual tax return	**File joint tax return**	**File married & separate tax return**	
$85,000 or less	$170,000 or less	$85,000 or less	$134
above $85,000 up to $107,000	above $170,000 up to $214,000	Not applicable	$187.50
above $107,000 up to $133,500	above $214,000 up to $267,000	Not applicable	$267.90
above $133,500 up to $160,000	above $267,000 up to $320,000	Not applicable	$348.30
above $160,000	above $320,000	above $85,000	$428.60

Get more information about your Part B premium from Social Security [PDF, 341 KB].

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