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CASE STUDY: FINANCIAL CHOICES FOR THE TAYLOR FAMILY

\* This case was prepared jointly by Jarrod Wilcox, Wilcox Investment, Inc. and Gayle Buff, Buff Capital Management. To protect client privacy, it is a fictionalized composite of realistic issues met in investment advisory work for private wealth in the US.

## FINANCIAL CHOICES FOR THE TAYLOR FAMILY

### THE TWO ADVISERS

*December 4, 2001*

Gayle Buff, CFA, an investment adviser (Buff Capital Management) in Newton, Massachusetts, has just telephoned Jarrod Wilcox, CFA, (Wilcox Investment, Inc.) to tell him about a possible opportunity for some collaborative work together. Gayle runs an independent advisory business with more than a hundred private clients, and has been in practice for about fifteen years. She is interested in newer quantitative techniques, hoping they could help do a good job for clients, and perhaps save her some time, but is a little skeptical because of the greater complexity of dealing with individuals and families as compared to institutional investing. Jarrod, a former institutional money manager, is well aware of the difficulties advisors to high net worth individuals and families face in using modern portfolio techniques. He believes he has developed innovative new approaches that will help close the gap between academic theory and practical work. He eagerly accepts the opportunity to demonstrate them.

Gayle has already had an initial client meeting in which the process was explained and the necessary paperwork for advisory, trading and custody agreements was completed. She now gets permission from Richard Taylor, a surgeon, and his wife Sarah, a real estate broker, to bring Jarrod into their case, and sets up a first joint meeting to understand more fully their situation.

## RICHARD AND SARAH TAYLOR

*December 15, 2001*

After initial introductions, Richard begins.

“My top priority is growing our investment portfolio. I am a surgeon, pretty successful, I guess you could say. I’ve been working on some changes in surgical instrumentation that I think show real promise. I’d like to be in a position to supplement grant monies for future surgical inventions. I’ve also been exploring commercial opportunities with a small start-up company, along with a couple of my surgical colleagues. I feel strongly that this work will benefit patients, and at the same time, there is a chance for serious monetary gains for our family. Sarah would like to feel more secure with our current situation and have a better idea of what we can afford to take on. I agree, but I also think we need an aggressive stance with our invested assets to meet our goals. I’d also like to be able to do better than the S&P 500 index fund, while not jeopardizing principal, and am willing to pay for it. Sarah, why don’t you tell them what has been bothering you?”

Sarah requests help with family finances and a second opinion on the allocation of investments.

“I have been a part-time real estate broker since our boys got old enough to pretty much take care of themselves. I love it, but housing activity is slowing. I am very concerned about taking on more debt to keep up with expenses, as we have been doing. In part, I think we just try to deal with bills as they come up, and the fluctuations in my sales commissions make it difficult to plan. We are always borrowing and paying interest. We have recently experienced a rather significant loss in our investment portfolio and I wonder if we may have been too aggressive there. Our broker is planning to retire. Richard believes that we need to push for better returns on our funds to improve our position. Okay, but I would also like to feel more secure with our current spending and savings and have a better idea of what we can afford.”

After a few comments back and forth on the need for a comprehensive financial picture, Gayle and Jarrod begin a more methodical fact collection. The clients are a husband and wife, age 45 and 42. They are a two-earner family with two maturing children, Sam in his last year of high school and John in his first year of high school. Richard is a partner in a highly successful group medical practice specializing in heart surgery. He has also been getting patent royalties on surgical instrumentation. He has already accumulated significant investment holdings, most of which is located in retirement plans. Sarah is a high-end commissioned real estate broker, working part-time with an annual income that varies between \$80 thousand and \$200 thousand annually.

Sarah abruptly leans forward in her chair, clearly with more on her mind. Gayle encourages her to go on:

“John starts his second year of high school in the fall and Sam will live away from home at college. I would like Richard to ask his father if he intends to help with Sam’s college expenses next fall. We want to enroll our son John at a private school that specializes in working with children with attention deficit disorder – John was diagnosed in the sixth grade. But can we afford to send him? Richard feels that even if we must borrow to fund his education, it is an investment in John’s future and he must attend. I’m also worried that if anything happens to Richard, I would be unable to sustain our current lifestyle. Richard feels I worry needlessly. But he wants to set up a business to develop and market surgical instruments. I’m worried about loss of income from his surgical practice, and possible harm to our other assets, should anything unforeseen occur.”

Gayle and Jarrod continue to collect financial information, and by the end of the meeting they have put together a reasonably complete estimate of the Taylor's annual income and expenditures, financial balance sheet and list of investments. [See Appendix A.]

One important sidelight that emerges in the conversation is that Richard's parents are moderately wealthy, and have hinted at their interest in estate planning, but Richard has been too uncomfortable to pursue the matter.

Gayle asks further questions to solidify her understanding of the real constraints on any recommendations she might make. The answers prove reasonably satisfactory and lead to a discussion of goals for wealth transfer and desires for family welfare. There seems to be enough insurance coverage for Richard as the major income provider in the event of his death or disability. Then Gayle asks about what business agreements are in place with his partners in medical practice if Richard is unable to continue working. This leads to a more general discussion of trusts and insurance. Gayle points out that the ability to transfer personal risk to the insurers generally enables one to take more risk on the investment side, believing that this may also appeal to Sarah's need for safety.

Gayle goes on to ask detailed questions on the list of assets, who owns or has title to each asset, whether the profit-sharing plans are qualified for tax deferral, and who the beneficiaries are on each account. She asks if there are expected gifts either to or from the family, what is the contribution amount of the medical practice pension plan, and asks what retirement plan Sarah has set up for her real estate sales. "What are plans on

funding IRAs [a government-sponsored plan for pre-tax funding of individual retirement accounts] in the future – how much? She also asks for the Taylor’s latest tax return and the trust document for the Taylor Family trust, which is the contingent beneficiary in case of the deaths of Richard and Sarah, the two boys being its further beneficiaries.

Finally, Jarrod describes the process of setting up a “life balance sheet” [See Appendix B] and asks some questions to help construct it.

1. *Jarrod*: “Do you feel your current savings rate, at about \$82 thousand a year, is sustainable?” *Richard*: “Yes, assuming we can get our current imbalance under control.”
2. *Jarrod*: “At what age do you think you will stop working?” *Sarah*: “I like my work, but I don’t like to have to depend on it. I’d like to quit when I’m 55.” *Richard*: “I can’t imagine retiring. Well, I guess I’ll be out of surgery by 70.”
3. *Jarrod*: “What percentage of your current expenses will you need in retirement? Think in terms of today’s dollars.” *Richard*: “Maybe you can help us estimate this.” [After some discussion, Sarah and Richard agree that after Richard’s retirement, and until one of them dies, they will jointly need about 80% of their current spending rate after subtracting their savings into retirement plans, and the survivor will need only about 65%. To be on the safe side, they feel comfortable planning now for Richard to live to 87 and Sarah to 92, recognizing that if things look different in a few years, they can update their plan.]
4. *Jarrod*: “How much will the boy’s future education cost?” *Richard*: “Next year, we will start paying an average of \$45 thousand a year for Sam’s four-year college education, and hopefully that much for two more years of graduate school. We hope to start John next year in a private high school for three years, and the annual charge will be about \$30 thousand. Then he will also have, we hope, four years of college and even two more years of graduate school.”

5. *Jarrold*: “Richard, how much money will you need to start up a company with your colleagues? What is the probability that will actually happen?” *Richard*: “I’d say about \$80 thousand as backup and we’ve agreed that the founders will each put up \$200 thousand to get started. The probability of both is about 50%, and these expenditures could occur in about a year.”
6. *Jarrold*: “Do you contemplate any major wealth transfers for which you have not already provided?” *Richard*: “No, there are adequate provisions for the boys in case we both get into an accident in the next few years.”
7. *Jarrold*: “You will have to pay ordinary income tax on your retirement plans when you withdraw the funds. One scenario is that you will be in a slightly lower tax bracket (35% total rather than 40%) tax bracket and will want the funds distributed over 10 years beginning at age 70. Do you feel comfortable with that?” *Richard*: “Yes.”
8. *Jarrold*: “Do you have large gains in your brokerage account?” *Richard*: “No, we had almost a complete loss in an Internet stock this year, and that wiped out nearly all of our unrealized gains.”

At the end of the meeting, Richard asks what will happen next. Gayle says that she and Jarrod will provide recommendations that we all can sit down and discuss right after the end-of-year holidays.

### CASE QUESTIONS

Part A: Put yourself in Gayle’s place.

1. Sarah wants to make sure that her standard of living will be maintained as it is. She is also bothered by the need for close attention to their monthly cash flow, aggravated by her irregular income, which undermines her sense of security. When faced with financial uncertainty, she becomes increasingly worried and

wants to step back, unable to act. On the other hand, Richard is interested in putting their money to work so that they can enhance their future lifestyle. He wants to quickly move ahead, which gives him a feeling of control, though perhaps missing important details of their situation. How much risk should they take in their investments? [See Appendix F.]

2. Richard believes he can find a way to reliably earn a higher stock return than that of the S&P 500. He seems to think that is the main value-added an investment advisor provides, and that is what he is paying for. He has also heard from their old broker that you have to take risks to make money, but doesn't seem to have any idea of how much risk is necessary, and how much unnecessary. And he doesn't want to unduly endanger principal. How will you deal with these issues?
3. Looking over their list of investments, what recommendations would you make without any input from Jarrod?
4. Can you identify the likely impact of cognitive biases in the Taylors' thinking about investments? Would you try to increase Richard and Sarah's self awareness of how emotion or these biases were influencing their financial decisions?

5. Sarah's concern with risk in her monthly cash flow budget is affecting her ability to tolerate risk in the investment portfolio. How could she be made more comfortable?

Part B: Put yourself in Jarrod's place.

1. In what ways does advising the Taylors differ from your experience as a former portfolio manager for pension funds?
2. Which time discounting rate would you select for any present value calculations of future after-tax events, and why? You might want to use any of the following assumptions – the expected inflation rate is 1%. The yield on high quality non-taxable municipal bonds is 4%. Over longer periods, stock returns have averaged 6%, bonds 1%, and cash 0% in excess of the inflation rate.
3. Do the Taylors have enough wealth to cover their financial plans? [See Appendix B.]
4. The discretionary wealth approach to setting risk policy is based on an extended balance sheet assessment of the ratio of total wealth to discretionary wealth. A ratio between 2 and 4 is typical among high net worth investors. What does the ratio for the Taylors indicate for them on the spectrum of “should be aggressive” versus “should be conservative”?

5. So that you can clarify the quantitative picture for Gayle and the Taylors, first look at asset allocation policy using just three asset classes – stocks, bonds and cash (short-term fixed income). Assume as a hypothetical that all their funds were held in ordinary brokerage accounts. [See Exhibit 1 in Appendix E]. Compare the indications for percentage allocation based on the simplified formulas in Appendix E with the Excel spreadsheet result shown for that example with non-negativity constraints. Would you recommend more bonds for the Taylors? How would you explain your reasoning? How would you change the inputs used in the analysis if you were in Jarrod's place?
  
6. Instead of assuming that all the investments were in fully taxable brokerage accounts, assume instead that although totals in retirement plans and brokerage accounts were constrained to their existing weights in the portfolio, the locations of stocks, bonds and cash could be varied. How would that change the best allocation among stocks, bonds and cash, both in total and by location among retirement accounts and taxable accounts? [See Appendix A, Appendix D and Exhibit 2 in Appendix E.] Under what conditions would it be more attractive to hold stocks in retirement accounts and bonds in ordinary fully taxable brokerage accounts?
  
7. How much expected improvement in annual pre-tax return over a 25 year period would be needed by an active investment manager with 100% annual turnover to

do better than passive holdings with no turnover, in a fully taxable brokerage account? Assume that trading costs are negligible. What if the holdings were in a retirement account? Is an assumption of no turnover realistic? What would be the impact of preferentially selling stocks with losses in a taxable brokerage account?

Part C: How successful do you feel Jarrod's quantitative techniques will be in this case, given its complexities and its many unknowns? How will the use of more quantitative methods affect Gayle's effort to resolve the differences in concerns between Sarah and Richard? What would have to happen in practice for Gayle to feel comfortable using these techniques? Would they help or hurt the economics of her business in terms of time spent and perceived value added? Could you afford to spend this much time on client customization and tax complexity in your work?

## EPILOGUE

*January 25, 2005*

Jarrold and Gayle continue to collaborate on other projects, but it is not until three years later that Jarrod asks whatever happened to the Taylors. Gayle brings Jarrod up to date:

“Jarrod, Sarah reports they did send John to a private high school and he will start college this fall, at a good school. Sam is considering applying to medical school. Richard is quite pleased. But as Sarah was beginning to feel more comfortable with their financial situation, they got news of her Dad's illness – Alzheimer's. Her mom was devastated and is very upset about how they are going to manage. Sarah and Richard

pledged to help them. They understood that this could entail rather significant financial support on their part for some time. Richard's work on a new heart procedure did not go well. With the uncertainty of Sarah's parents' situation, he is still reluctant to invest in that start-up. As a result of our encouragement and their experience with Sarah's family, Richard did approach his parents to discuss their estate plans. They were very forthcoming about their desire to help the grandchildren and start a gifting program. Richard felt relieved, and, told Sarah that he had felt the discussion opened the door to future talks. The Taylor portfolio has performed well – much steadier growth without a big (negative) surprise as in the past. They understand risk better and still appreciate your input, Jarrod, three years later.”

## **APPENDICES**

### *Appendix A. Information Provided By Richard and Sarah Taylor*

**Exhibit A.1. Personal Balance Sheet for Richard and Sarah Taylor**

**December, 2001**

**Thousands of Dollars**

**Assets**

**Financial Assets:**

Checking Account	15
Savings Account	25
Investment/ Brokerage Accts. Joint	1,000
Cash Value Life Insurance Policy	50
IRA, Sarah Taylor	25
IRA, Richard Taylor	250
Profit Sharing, Sarah Taylor	250
Profit Sharing, Richard Taylor	750
Surgeons Care Group Plan	2,300
<b>Total Financial Assets</b>	<b>4,665</b>

Automobiles	50
Jewelry	10
Furniture and appliances	50
Stereo, video equipment, computer	15
Art and antique rugs	25
Real Estate: Primary Residence	1,100
Real Estate: Vacation Home	<u>750</u>
<b>Total Assets</b>	<b>6,665</b>

**Liabilities**

**Current Liabilities**

Credit Card Debt	25
Car Loan, current portion	12
Mortgage--Primary Residence, current portion	70
Mortgage--Vacation Home, current portion	<u>36</u>

**Total Current Liabilities** 143

Car Loan	25
Equity Line of Credit owed	575
Mortgage--Primary Residence	525
Mortgage--Vacation Home	<u>400</u>

**Total Liabilities** 1,668

**Net Worth** 4,997

**Total Liabilities and Net Worth** 6,665

**Exhibit A.2. Income and Expense Statement for the Taylor Family, 2001**

<b>Income</b>			<b>Disbursements</b>		
Earnings	Sarah Taylor	95000	Fixed Payments and Savings Plans:		
Earnings	Richard Taylor	525000	Mortgage:	Primary residence	70000
Royalties	Richard Taylor	25000	Mortgage:	Vacation property	36000
Interest		2500	Auto Loan:		12000
Dividends		20000	Credit Card Debt:		25000
Capital Gains		12000	Real Estate Tax: Primary residence		15000
Total		679500	Real Estate Tax: Vacation property		9000
Taxes on Income:			Insurance: Primary residence		900
Federal		170000	Profit Sharing Sarah Taylor		12000
State		35000	Profit Sharing Richard Taylor		35000
FICA		29000	Group Plan Richard Taylor		35000
Total		234000	Total		249900
<b>Income After Tax</b>			Variable Expenses:		
<b>445500</b>			Food Purchases		25000
<b>Net Cash Flow</b>			Restaurant Meals		7500
<b>-20850</b>			House Maintenance		85000
			Utilities		6000
			Clothing		10000
			Transportation		5250
			Healthcare		2500
			Personal Care		5500
			Housecleaning		5000
			Attorney		1500
			Financial Advisor		25000
			Accountant		2500
			Total		180750
			Lifestyle Expenses:		
			Charitable Contributions		5000
			Home Furnishings		3000
			Subscriptions		1500
			Books		1200
			Recreation		2000
			Vacation and Travel		21000
			Gifts		2000
			Total:		35700
			<b>Expenses Total:</b>		<b>466350</b>

**Exhibit A.3. Account List - Richard & Sarah Taylor, November 30, 2001**

<b>Custodian</b>	<b>Account Title</b>	<b>Account Detail</b>	<b>Market Value</b>	
			<b>(000's of \$)</b>	<b>%</b>
Merrill Lynch	Sarah & Richard Brokerage WROS	Abbott	95	2%
		Biotronik AG	68	1%
		Boston Scientific	45	1%
		Dow Jones US Technology Sector	112	2%
		Dow Jones US Telecommunications Sector	71	2%
		Medtronic	58	1%
		Merrill Lynch 2008 Med. Term NT 06/01/08	100	2%
		Merrill Lynch Cash Management	75	2%
		MIV Therapeutic	91	2%
		REVA Medical (privately held)	292	6%
<b>Total Account Value</b>			<b>1007</b>	<b>22%</b>
Vanguard	Sarah IRA Sarah IRA Richard IRA Richard IRA	Vanguard 500 Index Fund	16	0%
		Vanguard Wellesley Income	10	0%
		Vanguard Emerging Markets	202	4%
		Vanguard Primecap	54	1%
<b>Total Account Value</b>			<b>282</b>	<b>6%</b>
Smith Barney	Richard Pension	Surgeon Care Group Pension 401(k) Plan	2303	50%
<b>Total Account Value</b>			<b>2303</b>	<b>50%</b>
UBS	Sarah Profit-Sharing Richard Profit-Sharing Richard profit-Sharing	Russell 2000 Growth Index	249	5%
		MSCI EAFE Index Fund	511	11%
		Invitrogen	249	5%
<b>Total Account Value</b>			<b>1009</b>	<b>22%</b>
<b>Total Value</b>			<b>4601</b>	<b>100%</b>

**Appendix B. Expanding the Balance Sheet**

Memo To: Gayle Buff  
 From: Jarrod Wilcox  
 Date: December 20, 2001  
 Re: The Taylor's Financial Situation

I think a life balance sheet could be very useful in helping communicate to the Taylors their financial situation and in giving them some guidance on how to go about meeting their financial goals and commitments. To be comprehensive, it needs to take into account the present values of future cash flows that can be reasonably projected.

At least for the time being, let's see what happens if we were to plan on continuing the Taylor's lifestyle at a level consistent with their personal possessions, primary residence and vacation home. Let's assume they also need their current working cash and insurance. Then, to start, their current financial balance sheet can be simplified as follows.

<b>Exhibit 1. Relevant Financial Balance Sheet</b>	
<b>December, 2001</b>	<b>Thousands of Dollars</b>
<b>Assets</b>	
Savings Account	25
Investment/ Brokerage Accts. Joint	1,000
IRA, Sarah Taylor	25
IRA, Richard Taylor	250
Profit Sharing, Sarah Taylor	250
Profit Sharing, Richard Taylor	750
Surgeons Care Group Plan	2,300
<b>Total Financial Assets</b>	<b>4,600</b>
<b>Liabilities</b>	
Equity Line of Credit owed	575
<b>Net Financial Wealth</b>	<b>4,025</b>

What's missing here is anything that we know about their future cash flows. What are their implied assets and liabilities?

*Implied assets* include the present value of the Taylor's future savings from employment or business activities, after living expenses are met.

*Implied liabilities* include the net present values of the taxes they will owe on the principal contributions to their pre-tax funding of retirement, of their educational funding

for their children and of their living expenses that they will have to meet out of their own investment and savings portfolio after retirement. One more, the expected present value for starting a new business, requires multiplying by a probability since it is far from certain. At some point in the future, the Taylors will likely need to start thinking about improved provisions for charitable giving, for further wealth transfer to their children and for estate tax minimization, but let's not tackle those issues yet.

Present value calculations require a time-discounting rate and specification of the time periods involved. The formula for calculating the present value of a stream of certain cash payments or withdrawals that begins at the end of the next period (an ordinary annuity) is:

$$PV = C \left[ \frac{1 - (1 + i)^{-n}}{i} \right]$$

Where:

$C$  is the cash payment or withdrawal each period

$i$  is the time discounting rate

$n$  is the number of periods  $C$  is repeated.

If the stream of cash flows begins in the future, the formula becomes:

$$PV = C \left[ \frac{1 - (1 + i)^{-n1}}{i} \right] / (1 + i)^{n2}$$

Where:

$n2$  is the number of periods until the cash flow stream begins

$n1$  is the number of periods it continues.

To take an example, suppose that we expect to spend \$300,000 a year for twenty years, starting fifteen years from now. How much would we need now, after tax, to finance that in today's dollars? Use a time discount rate (after-tax, after inflation) of 3%. Then the combined formula would give  $\$300,000 * [(1 - 0.554) / 0.03] / 1.56$ , or about \$2.86 million dollars.

The most conservative way to do this kind of calculation is to use a time discount rate based on a current local municipal bond yield (since nearly tax-free) less an estimate of the inflation rate. This gives an after-tax real interest rate.

I've drawn up an expanded balance sheet (Exhibit 2) for the Taylors using my own estimates. The net figure remaining, which I label "*discretionary wealth*" in the chart, is very interesting. If that becomes negative, it signals a shortfall of the Taylor's financial position compared to their financial goals and commitments. Exhibit 3 shows how I got to my present value estimates using the annuity formula, a simpler time discount formula for single payments, and a time discount rate of 3%.

**Exhibit 2. Expanded Balance Sheet**

<b>December, 2001</b>	<b>Thousands of Dollars</b>
<b>Assets</b>	
<b>Investment Assets</b>	
Savings Account	25
Investment/ Brokerage Accts. Joint	1,000
IRA, Sarah Taylor	25
IRA, Richard Taylor	250
Profit Sharing, Sarah Taylor	250
Profit Sharing, Richard Taylor	750
Surgeons Care Group Plan	2,300
<b>Total Investment Assets</b>	<b>4,600</b>
<b>Implied Assets</b>	
Net PV of Richard's Savings until Retirement	969
Net PV of Sarah's Savings until Retirement	107
<b>Total Implied Assets</b>	<b>1,077</b>
<b>Total Assets</b>	<b>5,677</b>
<b>Liabilities</b>	
<b>Investment Liabilities</b>	
Equity Line of Credit owed	575
<b>Total Investment Liabilities</b>	<b>575</b>
<b>Implied Liabilities</b>	
PV of Taxes on Value of Retirement Plans	506
PV of Withdrawals for Children's College Educ:	552
PV of Joint Withdrawals for Retirement	1933
PV of Survivor Withdrawals for Retirement	507
PV of Richard's Research & Business Startup	136
<b>Total Implied Liabilities</b>	<b>3634</b>
<b>Total Liabilities</b>	<b>4,209</b>
<b>Discretionary Wealth</b>	<b>1,467</b>

**Exhibit 3. Calculating Implied Assets and Liabilities**

<b>Time discount rate</b>	<b>0.03</b>		
<b>IMPLIED ASSETS</b>		<b>IMPLIED LIABILITIES</b>	
<b>Richard's Savings</b>		<b>Taxes on Existing Retirement Plans</b>	
Contributions per year	70	<b>Richard</b>	
Starting period	0	Expense per year	115.5
Ending period	25	Starting period	25
PV	<b>1219</b>	Ending period	35
<b>Less PV of Ending Tax</b>		PV	<b>471</b>
Payments per year	61	<b>Sarah</b>	
Starting period	25	Expense per year	10
Ending period	35	Starting period	28
PV	<b>-250</b>	Ending period	38
<b>Sarah's Savings</b>		PV	<b>36</b>
Contributions per year	12	<b>Educational expenses</b>	
Starting period	0	<b>Sam</b>	
Ending period	13	Expense per year	45
PV	<b>128</b>	Starting period	0
<b>Less PV of Ending Tax</b>		Ending period	6
Payments per year	5	PV	<b>244</b>
Starting period	28	<b>John</b>	
Ending period	38	Expense per year	30
PV	<b>-20</b>	Starting period	0
		Ending period	3
		PV	<b>85</b>
		Expense per year	45
		Starting period	3
		Ending period	9
		PV	<b>223</b>
		<b>Retirement</b>	
		<b>Joint</b>	
		Expense per year	307
		Starting period	25
		Ending period	42
		PV	<b>1933</b>
		<b>Survivor</b>	
		Expense per year	250
		Starting period	42
		Ending period	50
		PV	<b>507</b>
		<b>Business Startup</b>	
		Expense	280
		Periods from now	1
		Possible PV	<b>272</b>
		Probability	0.5
		Expected PV	<b>136</b>

What is important here is not the exact figure, but rather getting the ratio of assets to discretionary wealth into the right range to set risk policy. More information on this approach, especially as it evolves over the investor's lifecycle, can be found in Chapter 3 of Wilcox, J., Horvitz, J. and diBartolomeo, D. (2006), *Investment Management for Taxable Private Investors*, Research Foundation of the CFA Institute.

### ***Appendix C. Prescribing Risk Policy***

Memo To: Gayle Buff

From: Jarrod Wilcox

Date: December 27, 2001

Re: The Discretionary Wealth Approach to Setting Risk Management Policy

In my experience, investors don't have a good way to decide how much risk to take currently in order to achieve their long-term goals. Here is my recommendation for the investor who wants to maximize median long-term results without intermediate shortfalls:

1. *Maximize expected log return of discretionary wealth each period.* This will maximize median long-term compounded results. Expected log return on discretionary wealth  $\approx LE - L^2V/2$ , where  $L$  is the ratio of assets to discretionary wealth,  $E$  is the expected arithmetic return, and  $V$  is its variance.
2. Sometimes  $LE - L^2V/2$  is not a good enough approximation of expected log return on discretionary wealth. Then we need to include additional parameters of the probability distribution for arithmetic returns, including skewness and

kurtosis, to deal with unusual downside risk. But the benefit is usually very small for a diversified portfolio in typical high net worth situations.

3. Unless a major financing decision is being contemplated, the relative emphasis to be given return versus risk each period can be calculated by dividing through by  $L$ , giving us an objective of maximizing  $E - LV / 2$ . Consequently, the ratio  $L$  gives us what we need to optimize risk-taking through Markowitz mean-variance optimization.

For example, suppose that total assets were \$6MM and discretionary wealth were \$2MM. Suppose that average portfolio return expected is 7%, with an annual risk (standard deviation) of 12%. Then when we take discretionary wealth as our frame of reference, the expected annual return is amplified by three times ( $6/2$ ) to 21% and the expected risk is amplified to 36%. The approximate expected log return on discretionary wealth is  $0.21 - 0.36 * 0.36 / 2$ , or a healthy 0.145. In contrast, if discretionary wealth were only 10% of assets, the same asset risk-taking would have given us  $0.70 - 1.2*1.2 / 2$ , or an unhealthy -0.02, which if repeated very many times would eventually lead to a shortfall. In this case, we would conclude that the investor is over-leveraged relative to discretionary wealth, and either needs to reduce assets or reduce the risk in the asset portfolio.

$L$ , the investor's implicit leverage, does *not* imply outside borrowing, although it has a similar amplifying effect on risk and return. It needs to be assessed periodically, because

it varies through time. More on this topic can be found in Wilcox, J. (2003), "Harry Markowitz and the Discretionary Wealth Hypothesis," *Journal of Portfolio Management*.

***Appendix D. Tax Reduction and Effective Tax Rates***

Memo To: Gayle Buff  
From: Jarrod Wilcox  
Date: December 29, 2001  
Re: Tax Considerations

One of the biggest problems for new private wealth investment advisers used to institutional work is properly treating taxes. Here are my assumptions for the Taylors. Before retirement, the marginal ordinary income tax rates will be about 40%, combining Federal and State taxes, and this is the tax rate to be applied to their taxable interest income. After retirement, they will have little non-investment income, and I assume a lower ordinary income tax rate of 35% applicable to taxable interest and to withdrawals from retirement plans. I assume a 20% capital gains rate and a 20% tax on dividends for taxable investments, and that the Taylors will never incur the higher tax rate for short-term gains. In broad asset allocation studies such as this one, I do not consider the tax-advantaged municipal bonds as a separate asset class, since their lower interest rate comes close to offsetting their tax advantage.

The major complication is in estimating effective tax rates for securities that are tax-deferred. This is relevant both for fixed income and stocks in tax-deferred savings plans and for unrealized capital gains outside these plans. As you know, income in qualified pension plans is tax free until withdrawn, and is then taxed at ordinary income rates. The

capital gain tax is not imposed until the gain is “realized” by a sale. In either case the effective tax rate may be calculated from the following equation. This can be done easily in Microsoft Excel using the “goal seek” tool to force the difference between the two sides to zero by changing  $T^*$ . Otherwise use trial and error changes in the effective tax rate until you get the two sides of the equation to equal.

$$(1 + r(1-T^*))^n = (1 + r)^n(1 - T) + T$$

Where:

$r$  is the annual pre-tax return

$n$  is the number of periods

$T^*$  is the effective tax rate

$T$  is the nominal, or posted, tax rate.

For example, consider a tax deferred retirement plan. If annual  $r = 8\%$ ,  $n = 20$  years, and posted tax rate  $T = 40\%$ , then the two sides of the equation will be equal if  $T^* = 25\%$ . By reducing the effective tax rate from the ordinary income rate of 40% to a rate of 25%, the after tax return has been increased from 4.8% to 6%.

The effective tax rate has a very important role when it comes to asset allocation. Unless there is a big unused loss carryforward, I multiply both pre-tax expected return and return standard deviation by one minus the effective tax rate to get the after-tax expected return and risk. To be conservative, for taxable bond risk, I use the posted capital gains rate rather than the ordinary income tax rate applied to interest.

At this time, we are not considering the impact of estate and gift taxes for the Taylors because they don't want to consider any new plans for wealth transfers. But this will likely be a major concern for them later.

### ***Appendix E. Practical Mean-Variance Allocation***

Memo To: Gayle Buff  
From: Jarrod Wilcox  
Date: January 4, 2001  
Re: "Optimal" Portfolios

As we have discussed, a great many financial advisors to private individuals have had trouble applying Markowitz mean-variance optimization to real-life situations. I believe that for broad asset allocation the process is easier and more practical than most people think.

We want to find a set of asset weights that maximizes the expected portfolio return less a risk adjustment. The adjustment is to subtract the product of a risk aversion parameter and the portfolio return variance (return standard deviation squared). The sum of the weights for the assets must be 1, and often we also require that each asset's weight must be non-negative.

My earlier memo on the discretionary wealth approach indicated that using half the ratio of total assets to discretionary wealth, or  $L/2$ , as the Markowitz risk aversion parameter leads to the best long-run median outcome.

Then, in matrix notation, the problem is to maximize:

$$R'x - (L/2)x'Vx, \text{ subject to } \sum x = 1 \text{ and } x_i \geq 0$$

Where, if there are n assets:

$R'$  is a row vector of n expected returns

$x$  is a column vector of n weights,  $x'$  is its row vector form

$V$  is an n-by-n matrix of covariances

$L$  is the ratio of total assets to discretionary wealth.

This is simple, right? You can even set it up in Microsoft Excel using the “solver” add-in. But many otherwise very intelligent advisors have problems with mathematics. And even those who are good with numbers have criticisms of this Markowitz approach. Here are their main objections, together with my responses:

1. Objection: Investors do not know what their risk aversion coefficient should be.  
Response: We can guide the investor as to how much risk to take to fulfill their financial commitments by using the extended balance sheet and the resulting discretionary wealth approach to risk management.
2. Objection: It is a single period model, when what we care about is good performance over the long term. Response: We can capture what we know about

the future in the extended balance sheet. Along with the focus on log returns, this helps optimizing choices each period also to optimize the sequence of choices over many periods. The Markowitz mean-variance framework, with the appropriate risk aversion adjustments along the way, is usually a good approximation of this best policy.

3. Objection: It is overly sensitive to small changes in inputs. Response: A more advanced version of the problem set-up than shown here can take transaction costs into account, preventing expensive transactions that change the balance between expected portfolio return and risk by insignificant amounts. The incidence of this problem can be greatly reduced by confining the analysis to a few broad asset classes.
  
4. Objection: It assumes that statistical variance is a good indicator of what investors really care about, which is avoiding losses. Response: Despite its symmetry in taking into account both upside and downside excursions around an average, return variance is an excellent indicator of potential loss. Unless the investor has some combination of a large ratio of total to discretionary wealth, high variance in the underlying security returns, and long time period between rebalancing decisions, even relatively skewed or fat-tailed return distributions will not cause much error from using the Markowitz rule.

5. Objection: It assumes we know the inputs with certainty. Response: It is true that the Markowitz model takes no account of uncertainty in our knowledge of the input parameters. Well-established commercial suppliers of “optimizers” have developed good ways of minimizing this problem, but these will not be available to every financial advisor. Because of the highly non-linear relationships involved in determining the optimal asset weights, the process will tend to magnify any errors in the inputs. This problem becomes exponentially more severe as the number of assets increases. However, an asset allocation involving just the six broad categories of cash, bonds, and stocks, in both fully taxable and tax-deferred forms, is relatively safe, even using the very simple technology described here.

6. Objection: It is hard to understand and explain why it produces the results it does.

Response: Yes, it is sometimes hard to understand why Markowitz mean-variance optimization produces the results that it does, but this condition can be greatly improved with experience with small problems using Microsoft’s Excel spreadsheet with the “solver” add-in. For problems involving only three assets, such as stocks, bonds and cash, and assuming that the risk of cash ( $c$ ) is near zero, we can also get insight from simplified formulas for optimal weights:

a. If the estimated correlation between stock ( $s$ ) and bond ( $b$ ) returns is zero.

Then the optimal unconstrained weights for stocks and bonds are:

$$W_s = \frac{(r_s - r_c)}{LV_s}, W_b = \frac{(r_b - r_c)}{LV_b}, W_c = 1 - W_s - W_b$$

- b. If there are non-zero correlations between stock and bond returns, then we have, where  $V_{sb}$  stands for the return covariance between stocks and bonds:

$$i. W_s = \frac{[(r_s - r_c)V_b - (r_b - r_c)V_{sb}]}{L(V_s V_b - V_{sb}^2)}$$

$$ii. W_b = \frac{[(r_b - r_c)V_s - (r_s - r_c)V_{sb}]}{L(V_s V_b - V_{sb}^2)}$$

$$iii. W_c = 1 - W_s - W_b$$

The preceding formulas can result in negative weights, implying borrowing. Where this is not permitted, one needs to use a full optimization with constraints to get an accurate answer, for example using the solver add-in for Excel. Nevertheless, the formulas are usually enough to give a good idea of the relative asset proportions of stocks to the sum of the lower-risk assets required for best expected log return.



The location problem for where to put assets of different types among the fully taxable and tax-advantaged accounts can also be solved in this way. Exhibit 2 shows a solution for the same assumptions, but assuming different effective tax rates and risks based on the material of my memo on taxation and an assumption of paying ordinary income tax after 25 years. The effective tax rates, instead of a tax rate of 35% (the rate at the time the retirement account is presumed liquidated in this example), the effective tax rates are 20.4% for stocks, 29.4% for bonds and 32.3% for cash, assuming that their value is compounded at the growth rate expected. These adjustments actually very slightly increase the effective tax rate on stocks (from 20%) as compared to 100% annual turnover (the least favorable case) in a fully taxable account. However, they substantially improve the bond and cash tax rates, favoring locating fixed income in retirement accounts. Note that the solution now puts all the bonds, about half the proposed optimal portfolio, into the retirement accounts, and splits the stocks equally between retirement accounts and fully taxed accounts. This works well for the Taylors, because about three-quarters of their investable assets are in retirement accounts. In other cases, we could add additional constraints to the problem.

**Exhibit 2. Example Spreadsheet Optimizing Tax Location**

**MARKOWITZ MEAN-VARIANCE OPTIMIZATION WITH NON-NEGATIVITY CONSTRAINTS**

L	4							
Risk Aversion	2							
	OBJECTIVE		0.0218		Weights			
	Budget		1.0001		0.248037			
	Expected Return		0.0358		0			
	Expected Risk		0.0838		0			
	Exp log return on disc		0.0872		0.248036			
					0.504027			
					0			
mean	Stock	Bond	Cash	Taxed Stk	Taxed Bnd	Taxed Csh	0.035845	
sdev	0.16	0.056	0.00007	0.16	0.064	0.00006		
Correlations								
Stock	1	0	0	0.9	0	0		
Bond	0	1	0	0	0.9	0		
Cash	0	0	1	0	0	0.9		
Taxed Stk	0.9	0	0	1	0	0		
Taxed Bnd	0	0.9	0	0	1	0		
Taxed Csh	0	0	0.9	0	0	1		
Weight								
Minimums	0	0	0	0	0	0		
Covariance Matrix								
	0.0256	0	0	0.02304	0	0.00006	0.248037	
	0	0.003136	0	0	0.003226	0	0	
	0	0	4.9E-09	0	0	3.78E-09	0	
	0.02304	0	0	0.0256	0	0	0.248036	
	0	0.003226	0	0	0.004096	0	0.504027	
	0.00006	0	3.78E-09	0	0	3.6E-09	0	
	0.012064	0.001626	0	0.012064	0.002064	1.49E-05	0.0070	

**Appendix F. Understanding Client Behavior**

Memo To: Jarrod Wilcox  
 From: Gayle Buff  
 Date: January 11, 2002  
 Re: Emotion and Behavioral Finance

Behavioral finance looks at how people actually behave when faced with making a choice under risk. As someone very interested in psychology, I suppose I stress emotion as well as the cognitive biases that are mainly discussed in behavioral finance writings. At any rate, when we hold onto a view or feeling without further analysis, one could say that we have a certain cognitive or emotional bias. Often we are unaware of our own bias and often choose unwisely.

Why can't the Taylors be more rational, you may ask? In your last memo, Jarrod, on "Optimal" Portfolios, you raise a common objection of the Markowitz approach: "Investors do not know what their risk aversion coefficient should be." In my experience, people miss-estimate risk tolerance: both what they can tolerate emotionally and what they can safely estimate. For example, Richard Taylor is willing to pay for performance that beats the S & P. On the one hand he says he is willing to take on more risk to do so and on the other hand he does not want to jeopardize his current account principal. Typical of many investors, Richard overestimates both his ability (financial capacity) and willingness (tolerance) to bear risk. His misconceptions about risk can be characterized in the following manner:

- 1.) Richard uses no objective measure to form an estimate of risk. How he feels about risk is the sole criterion he uses for identifying an appropriate risk level.
- 2.) Richard doesn't understand what risk is in terms of probability of loss and realistic measures of it like variance.

3.) In order to realize higher rates of return, Richard believes he must take on more risk without enough appreciation of the possibility of loss.

Richard has increased his risk without fully considering the consequence. For example, when he invests in what he knows (medical companies), presumably to avoid risk, he has actually increased portfolio risk based on inadequate diversification.

Richard no doubt has learned to trust his surgical technique and has gained confidence in his skills. When he generalizes this ability to his financial affairs, he runs the risk of believing himself to be capable, but without any real reasons to support his view. He is “overconfident”. Studies show overconfident investors take more risk. Jarrod, I think if we provide Richard with the output from your asset allocation model and try to engage his reasoning faculties, we can enable him to understand the good reasons for your approach.

Unlike her husband, Sarah becomes paralyzed when faced with making a significant financial decision. She defers to Richard regarding investments but feels anxious when she must scramble to free up cash to pay the bills. In light of the overall positive financial situation the Taylors enjoy, Sarah’s feelings are puzzling. Behavioral researchers tell us, however, that it is very common for individuals to create “mental accounts” for various household or family assets. When the cash account is low, Sarah feels alarmed. It never occurs to her that they could have a cash account that serves two purposes. While it is true the Taylors would benefit from allocating their funds more efficiently, we also need

to pay attention to Sarah's "frame dependence" -- the way Sarah behaves is influenced by the way her decision problem is framed. When we talk with Sarah at our next meeting, I will try to reframe the problem. I may suggest, for instance, that she set aside funds in another account, in the event the cash account gets too low, as a reserve fund. Sarah prefers the certainty of available cash. I believe this will help alleviate her discomfort and facilitate her acceptance of other recommendations.

The use of mental accounts also appear to be obstructing the Taylor's ability to see the asset allocation problem in its proper context -- that is, as an integrated whole. I find it is quite common for investors to get the allocation of assets across taxable and tax-advantage locations wrong for this reason.

Jarrold, we add considerable value to our relationship with the Taylors when they have felt listened to and understood. We can have an enormous impact on their satisfaction and commitment to our recommendations if we remember to take this into account.