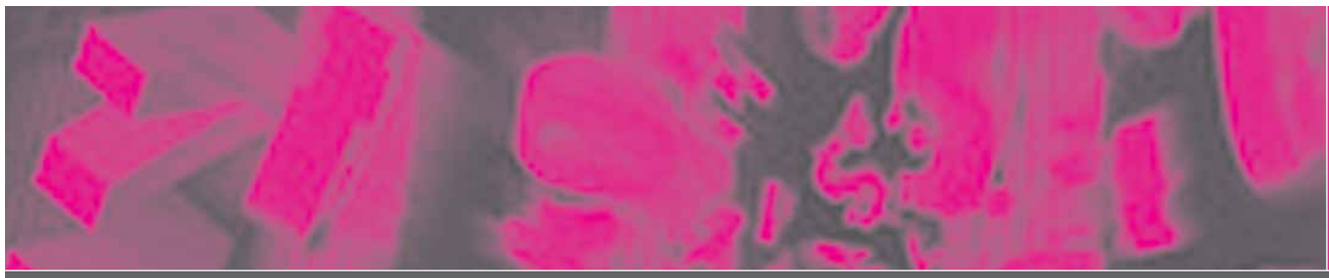

20

TAXES, INFLATION, AND INVESTMENT STRATEGY

AFTER STUDYING THIS CHAPTER YOU SHOULD BE ABLE TO:

- Analyze lifetime savings plans.
- Account for inflation in formulating savings and investment plans.
- Account for taxes in formulating savings and investment plans.
- Understand tax shelters.
- Design your own savings plan.

related WEBSITES

www.bloomberg.com
www.morningstar.com
www.quicken.com
financialplan.about.com
planning.yahoo.com
moneycentral.msn.com/planning/home.asp
These sites contain information on personal financial planning.

www.troweprice.com
flagship.vanguard.com
These mutual funds provide financial planning information, as well as some tax management advice.

www3.troweprice.com/ric/RIC
This site has a simulation model that can be used to assess the ability to meet retirement goals.

www.ssa.gov
For information on Social Security.

www.aarp.org
The AARP site offers information about retirement planning.

inflationdata.com/Inflation/default.asp
minneapolisfed.org/research/data/us/calc
These sites contain inflation data.

A good deal of investment management in practice revolves around the individual's need to devise and manage a lifetime savings and investment plan. This forces one to confront many real-world complications such as taxes and tax shelters, Social Security, insurance, and inflation. Our major objective in this chapter is to introduce you to the *principles* of managing personal savings in a complex environment in which taxes and inflation interact, rather than to provide a detailed analysis of the (ever-changing) tax code.

Retirement, purchase of a home, and financing the education of children are the major objectives of saving in most households. Inflation and taxes make the task of gearing investment to accomplish these objectives complex. The long-term nature of savings intertwines the power of compounding with inflation and tax effects. Only the most experienced investors tend to fully integrate these issues into their investment strategies. Appropriate investment strategy also includes adequate insurance coverage for contingencies such as death, disability, and property damage.

We introduce some of these issues by focusing on one of the long-term goals: formulating a retirement plan. We investigate the effect of inflation on the savings plan and examine how tax shelters may be integrated into one's strategy.[1] Next we incorporate Social Security and show how to generalize the savings plan to meet other objectives such as owning a home and financing children's education. Finally, we discuss uncertainty about longevity and other contingencies. Understanding the spreadsheets we develop along the way will enable you to devise savings/investment plans for yourself and other households and adapt them to an ever-changing environment.

20.1 SAVING FOR THE LONG RUN

Our objective in this chapter is to quantify the essentials of savings/investment plans and adapt them to environments in which investors confront both inflation and taxes.[2] In the next chapter we will describe the framework that the CFA Institute has established to help financial advisers communicate with and involve client households in structuring their savings/investment plans. As a first step, we set up a spreadsheet for a simple retirement plan, ignoring for the moment saving for other objectives.

Before diving in, a brief word on what we mean by saving. Economists think of saving as a way to smooth out the lifetime consumption stream; you save when you have high earnings in order to support consumption in low-income years. In a "global" sense, the concept

[1]Readers in other countries will find it easy to adapt the analysis to the tax code of their own country.

[2]Even if you do not read Chapter 21 carefully, you may want to skim through it to get an idea of how financial planners articulate a saver's objectives, constraints, and investment policy.

implies that you save for retirement so that consumption during the retirement years will not be too low relative to consumption during the saving years. In a "local" sense, smoothing consumption implies that you would finance a large purchase such as a car, rather than buy it for cash. Clearly, local consumption smoothing is of second-order importance, that is, how you purchase durable goods has little effect on the overall savings plan, except, perhaps, for very large expenditures such as buying a home or sending children to college. We begin therefore with a savings plan that ignores even large expenditures and later discuss how to augment the plan to account for these needs.

A Hypothetical Household

Imagine you are now 30 years old and have already completed your formal education, accumulated some work experience, and settled down to plan the rest of your economic life. Your plan is to retire at age 65 with a remaining life expectancy of an additional 25 years. Later on, we will further assume that you have two small children and plan to finance their college education.

For starters, we assume you intend to obtain a (level) annuity for your 25-year retirement period; we postpone discussion of planning for the uncertain time of death. (You may well live to over 100 years; what then?) Suppose your gross income this year was $50,000, and you expect annual income to increase at a rate of 7% per year. In this section, we assume that you ignore the impact of inflation and taxes. You intend to steadily save 15% of income and invest in safe government bonds that will yield 6% over the entire period. Proceeds from your investments will be automatically reinvested at the same 6% until retirement. Upon retirement, your funds in the retirement account will be used to purchase a 25-year annuity (using the same 6% interest rate) to finance a steady consumption annuity. Let's examine the consequences of this framework.

The Retirement Annuity

retirement annuity

Stream of cash flows available for consumption during one's retirement years.

We can easily obtain your **retirement annuity** from Spreadsheet 20.1, where we have hidden the lines for ages 32–34, 36–44, 46–54, and 56–64. You can obtain all the spreadsheets in this chapter from the Web page for the text: **www.mhhe.com/bkm**.

spreadsheet 20.1

The savings plan

	A	B	C	D	E
1	Retirement Years	Income Growth	Savings Rate	ROR	
2	**25**	**0.07**	**0.15**	**0.06**	
3	Age	Income	Savings	Cumulative Savings	Consumption
4	30	50,000	7,500	7,500	42,500
5	31	53,500	8,025	15,975	45,475
6	32	57,245	8,587	25,520	48,658
9	35	70,128	10,519	61,658	59,608
19	45	137,952	20,693	308,859	117,259
29	55	271,372	40,706	943,477	230,666
39	65	533,829	80,074	2,457,518	453,755
40	**Total**	**7,445,673**	**1,116,851**	Retirement Annuity	**192,244**

	A	B	C	D	E
1	Retirement Years	Income Growth	Savings Rate	ROR	
2	**25**	**0.07**	**0.15**	**0.06**	
3	Age	Income	Savings	Cumulative Savings	Consumption
4	30	50000	=B4*$C$2	=C4	=B4-C4
5	31	=B4*(1+$B$2)	=B5*$C$2	=D4*(1+$D$2)+C5	=B5-C5
39	65	=B38*(1+$B$2)	=B39*$C$2	=D38*(1+$D$2)+C39	=B39-C39
40	**Total**	**=SUM(B4:B39)**	**=SUM(C4:C39)**	Retirement Annuity	**=PMT($D$2,$A$2,-$D$39,0,0)**

These spreadsheets are available at **www.mhhe.com/bkm**

eXcel

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Let's first see how this spreadsheet was constructed. To view the formulas of all cells in an Excel spreadsheet, choose "Preferences" and select the box "Formulas" in the "View" tab. The

formula view of Spreadsheet 20.1 is also shown in Spreadsheet 20.1 (numbers are user inputs).

Inputs in row 2 include: retirement years (cell A2 = 25); income growth (cell B2 = .07); Age (column A); and income at age 30 (B4 = 50,000). Column B computes income in future years using the growth rate in cell B2; column C computes annual savings by applying the savings rate (cell C2) to income; and column E computes consumption as the difference between income and savings: column B − column C. Cumulative savings appear in column D. To obtain the value in D6, for example, multiply cell D5 by 1 plus the assumed rate of return in cell D2 (the ROR) and then add current savings from column C. Finally, C40 shows the sum of dollars saved over the lifetime, and E40 converts cumulative savings (including interest) at age 65 to a 25-year annuity using the financial function PMT from Excel's function menu. Excel provides a function to solve for annuity levels given the values of the interest rate, the number of periods, the present value of the savings account, and the future value of the account: PMT(rate, nper, PV, FV).

We observe that your retirement fund will accumulate approximately $2.5 million (cell D39) by age 65. This hefty sum shows the power of compounding, since your contributions to the savings account were only $1.1 million (C40). This fund will yield an annuity of $192,244 per year (E40) for your 25-year retirement, which seems quite attractive, except that the standard of living you'll have to get accustomed to in your retirement years is much lower than your consumption at age 65 (E39). In fact, if you unhide the hidden lines, you'll see that upon retirement, you'll have to make do with what you used to consume at age 51. This may not worry you much since, with your children having flown the coop and the mortgage paid up, you may be able to maintain the luxury to which you recently became accustomed. But your projected well-being is deceptive: get ready to account for inflation and taxes.

CONCEPT check

1. If you project an ROR of only 5%, what savings rate would you need to maintain the same retirement annuity?

20.2 ACCOUNTING FOR INFLATION

Inflation puts a damper on your plans in two ways: First, it erodes the purchasing power of the cumulative dollars you have so far saved. Second, the *real* dollars you earn on your portfolio each year depend on the *real* interest rate, which, as Chapter 5 showed, is approximately equal to the nominal rate minus inflation. Since an appropriate savings plan must generate a decent *real* annuity, we must recast the entire plan in real dollars. We will assume your income still is forecast to grow at a 7% rate, but now you recognize that part of income growth is due to inflation, which is running at 3% per year.

A Real Savings Plan

To convert nominal dollars to real dollars we need to calculate the price level in future years relative to today's prices. The "deflator" (or relative price level) for a given year is that year's price level divided by today's. It equals the dollars needed at that future date which provide the same purchasing power as $1 today (at age 30). For an inflation rate of $i = 3\%$, the deflator for age 35 is $(1 + i)^5$, or in Excel notation, (1 + *i*)^5 = 1.03^5 = 1.16. By age 65, the deflator is 2.81. Thus, even with a moderate rate of inflation (3% is below the historical average, as you can see from Figure 5.4), nominal dollars will lose a lot of purchasing power over long horizons. We also can compute the *real* rate of return (rROR) from the nominal ROR of 6%: rROR = (ROR − *i*)/(1 + *i*) = 3/1.03 = 2.91%.

Spreadsheet 20.2, with the formula view below it, is the reworked Spreadsheet 20.1 adjusted for inflation. In addition to the rate of inflation (cell C2) and the real rate of return (F2), the major addition to this sheet is the price level deflator (column C). Instead of nominal

spreadsheet 20.2

A real retirement plan

	A	B	C	D	E	F
1	Retirement Years	Income growth	Rate of Inflation	Savings rate	ROR	rROR
2	25	0.07	0.03	0.15	0.06	0.0291
3	Age	Income	Deflator	Saving	Cumulative Savings	rConsumption
4	30	50,000	1.00	7,500	7,500	42,500
5	31	53,500	1.03	8,025	15,975	44,150
9	35	70,128	1.16	10,519	61,658	51,419
19	45	137,952	1.56	20,693	308,859	75,264
29	55	271,372	2.09	40,706	943,477	110,167
39	65	533,829	2.81	80,074	2,457,518	161,257
40	Total	7,445,673		1,116,851	Real Annuity	49,668

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	A	B	C	D	E	F
1	Retirement Years	Income Growth	Rate of Inflation	Savings Rate	ROR	rROR
2	25	0.07	0.03	0.15	0.06	=(E2-C2)/(1+C2)
3	Age	Income	Deflator	Savings	Cumulative Savings	rConsumption
4	30	50000	1	=B4*$D$2	=D4	=(B4-D4)/C4
5	31	=B4*(1+$B$2)	=C4*(1+$C$2)	=B5*$D$2	=E4*(1+$E$2)+D5	=(B5-D5)/C5
39	65	=B38*(1+$B$2)	=C38*(1+$C$2)	=B39*$D$2	=E38*(1+$E$2)+D39	=(B39-D39)/C39
40	Total	=SUM(B4:B39)		=SUM(D4:D39)	Real Annuity	=PMT($F$2,$A$2,-$E$39/$C$39,0,0)

These spreadsheets are available at **www.mhhe.com/bkm**

consumption, we present **real consumption** (column F), calculated by dividing nominal consumption (column B − column D) by the price deflator, column C.

real consumption

Nominal consumption divided by the price deflator.

The numbers have changed considerably. Gone is the luxurious retirement we anticipated earlier. At age 65 and beyond, with a real annuity of $49,668, you will have to revert to a standard of living equal to that you attained at age 34; this is less than a third of your real consumption in your last working year, at age 65. The reason is that the retirement fund of $2.5 million (E39) is worth only $873,631 in today's purchasing power (E39/C39). Such is the effect of inflation. If you wish to do better than that, you must save more.

In our initial plan (Spreadsheet 20.1), we envisioned consuming a level, nominal annuity for the retirement years. This is an inappropriate goal once we account for inflation, since it would imply a declining standard of living starting at age 65. Its purchasing power at age 65 in terms of current dollars would be $68,320 (i.e., $192,244/$1.03^{35}$), and at age 90 only $32,630. (Check this!)

It is tempting to contemplate solving the problem of an inadequate retirement annuity by increasing the assumed rate of return on investments. However, this can only be accomplished by putting your savings at risk. Much of this text elaborates on how to do so efficiently; yet it also emphasizes that while taking on risk will give you an *expectation* for a better retirement, it implies as well a nonzero probability of doing a lot worse. At the age of 30, you should be able to tolerate some risk to the retirement annuity for the simple reason that if things go wrong, you can change course, increase your savings rate, and work harder. As you get older, this option progressively fades, and increasing risk becomes less of a viable option. If you do choose to increase risk, you can set a "safety-first target" (i.e., a minimum acceptable goal) for the retirement annuity and continuously monitor your risky portfolio. If the portfolio does poorly and approaches the safety-first target, you progressively shift into risk-free bonds—you may recognize this strategy as a version of dynamic hedging.

The difficulty with this strategy is twofold: First it requires monitoring, which is time-consuming and may be nerve-racking as well. Second, when decision time comes, it may be psychologically hard to withdraw. By shifting out of the risky portfolio if and when your portfolio is hammered, you give up any hope of recovery. This is hard to do and many investors fail the test. For these investors, therefore, the right approach is to stick with the safe, lower ROR and make the effort to balance standard of living before and after retirement. Avoiding sleepless nights is ample reward.

Therefore, the only variable we leave under your control in this spreadsheet is the rate of saving. To improve retirement life style relative to the preretirement years, without jeopardizing its safety, you will have to lower consumption during the saving years—there is no free lunch.

CONCEPT check

2. If you project a rate of inflation of 4%, what nominal ROR on investments would you need to maintain the same real retirement annuity as in Spreadsheet 20.2?

An Alternative Savings Plan

In Spreadsheet 20.2, we saved a constant fraction of income. But since real income grows over time (nominal income grows at 7% while inflation is only 3%), we might consider deferring our savings toward future years when our real income is higher. By applying a higher savings rate to our future (higher) real income, we can afford to reduce the current savings rate. In Spreadsheet 20.3, we use a base savings rate of 10% (lower than the savings rate in the previous spreadsheet), but we increase the savings target by 3% per year. Saving in each year therefore equals a fixed savings rate times annual income (column B), times 1.03^t. By saving a larger fraction of income in later years, when real income is larger, you create a smoother profile of real consumption.

spreadsheet 20.3

Backloading the real savings plan

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	A	B	C	D	E	F
1	Retirement Years	Income Growth	Rate of Inflation	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**0.1**	**0.06**	**0.0291**
3	Age	Income	Deflator	Savings	Cumulative Savings	rConsumption
4	30	50,000	1.00	5,000	5,000	45,000
5	31	53,500	1.03	5,511	10,811	46,592
9	35	70,128	1.16	8,130	44,351	53,480
19	45	137,952	1.56	21,492	260,927	74,751
29	55	271,372	2.09	56,819	947,114	102,471
39	65	533,829	2.81	150,212	2,964,669	136,331
40	**Total**	**7,445,673**		**1,572,466**	**Real Annuity**	**59,918**

	A	B	C	D	E	F
1	Retirement Years	Income Growth	Rate of Inflation	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**0.1**	**0.06**	**=(E2-C2)/(1+C2)**
3	Age	Income	Deflator	Savings	Cumulative Savings	rConsumption
4	30	50000	1	=B4*C4*$D$2	=D4	=(B4-D4)/C4
5	31	=B4*(1+$B$2)	=C4*(1+$C$2)	=B5*C5*$D$2	=E4*(1+$E$2)+D5	=(B5-D5)/C5
39	65	=B38*(1+$B$2)	=C38*(1+$C$2)	=B39*C39*$D$2	=E38*(1+$E$2)+D39	=(B39-D39)/C39
40	**Total**	**=SUM(B4:B39)**		**=SUM(D4:D39)**	**Real Annuity**	**=PMT($F$2,$A$2,-$E$39/$C$39,0,0)**

These spreadsheets are available at **www.mhhe.com/bkm**

Spreadsheet 20.3 shows that with an *initial* savings rate of 10%, compared with the unchanging 15% rate in the previous spreadsheet, you can achieve a retirement annuity of $59,918, larger than the $49,668 annuity in the previous plan.

Notice that real consumption in the early years is greater than with the previous plan. What you have done is to postpone saving until your income is much higher. At first blush, this plan is preferable: It allows for a more comfortable consumption of 90% of income at the outset, a consistent increase in standard of living during your earning years, all without significantly affecting the retirement annuity. But this program has one serious downside: By postponing the bulk of your savings to a later age, you come to depend on your health, longevity, and, more ominously (and without possibility of insurance), on a successful future career. Put differently, this plan achieves comfort by increasing risk, making this choice a matter of risk tolerance.

CONCEPT check

3. Suppose you like the plan of tilting savings toward later years, but worry about the increased risk of postponing the bulk of your savings to later years. Is there anything you can do to mitigate the risk?

20.3 ACCOUNTING FOR TAXES

flat tax

A tax code that taxes all income above some exemption at a fixed rate.

To initiate a discussion of taxes, let's assume that you are subject to a **flat tax** rate of 25% on taxable income less one exemption of $15,000. This is similar to several proposals for a simplified U.S. tax code that have been floated by one presidential candidate or another prior to elections—at least when you add state taxes to the proposed flat rate. An important feature of this (and the existing) tax code is that the tax rate is levied on nominal income and applies as well to investment income. (This is the concept of double taxation—you pay taxes when you earn income and then you pay taxes again when your savings earn interest). Some relief from the effect of taxing nominal dollars both in this proposal and the current U.S. code is provided by raising the exemption, annually, by the rate of inflation. To adapt our spreadsheet to this simple tax code, we must add columns for taxes and after-tax income. The tax-adjusted plan is shown in Spreadsheet 20.4. It adapts the savings plan of Spreadsheet 20.2.

spreadsheet 20.4

Saving with a simple tax code

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	A	B	C	D	E	F	G	H
1	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax Rate	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**15000**	**0.25**	**0.15**	**0.06**	**0.0291**
3	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
4	30	50,000	1.00	15,000	8,750	6,188	6,188	35,063
5	31	53,500	1.03	15,450	9,605	6,584	13,143	36,224
9	35	70,128	1.16	17,389	13,775	8,453	50,188	41,319
19	45	137,952	1.56	23,370	31,892	15,909	245,334	57,864
29	55	271,372	2.09	31,407	69,943	30,214	733,467	81,773
39	65	533,829	2.81	42,208	148,611	57,783	1,874,346	116,365
40	**Total**				**1,884,163**	**834,226**	**Real Annuity=**	**37,882**
41	**RETIREMENT**							
42	Age	Nom Withdraw	Deflator	Exemption	Taxes		Funds Left	rConsumption
43	66	109,792	2.90	43,474	17,247		1,877,014	31,931
47	70	123,572	3.26	48,931	15,743		1,853,382	33,056
52	75	143,254	3.78	56,724	12,200		1,721,015	34,656
57	80	166,071	4.38	65,759	6,047		1,422,954	36,503
62	85	192,521	5.08	76,232	0		883,895	37,882
67	90	223,185	5.89	88,374	0		0	37,882
68	**Total**	**4,002,944**			**203,199**			

	A	B	C	D	E	F	G	H
1	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax Rate	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**15000**	**0.25**	**0.15**	**0.06**	**=(G2-C2)/(1+C2)**
3	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
4	30	50000	1	=$D$2*C4	=(B4-D4)*$E$2	=(B4-E4)*$F$2	=F4	=(B4-E4-F4)/C4
5	31	=B4*(1+$B$2)	=C4*(1+$C$2)	=$D$2*C5	=(B5-D5+G4*$G$2)*$E$2	=(B5-E5)*$F$2	=G4*(1+$G$2)+F5	=(B5-E5-F5)/C5
39	65	=B38*(1+$B$2)	=C38*(1+$C$2)	=$D$2*C39	=(B39-D39+G38*$G$2)*$E$2	=(B39-E39)*$F$2	=G38*(1+$G$2)+F39	=(B39-E39-F39)/C39
40	**Total**				**=SUM(E4:E39)**	**=SUM(F4:F39)**	**Real Annuity**	**=PMT($H$2,$A$2,-$G$39/$C$39,0,0)**
41	**RETIREMENT**							
42	Age	Nom Withdraw	Deflator	Exemption	Taxes		Funds Left	rConsumption
43	66	=$H$40*C43	=C39*(1+$C$2)	=$D$2*C43	=MAX(0,(G39*$G$2-D43)*$E$2)		=G39*(1+$G$2)-B43	=(B43-E43)/C43
44	67	=$H$40*C44	=C43*(1+$C$2)	=$D$2*C44	=MAX(0,(G43*$G$2-D44)*$E$2)		=G43*(1+$G$2)-B44	=(B44-E44)/C44
67	90	=$H$40*C67	=C66*(1+$C$2)	=$D$2*C67	=MAX(0,(G66*$G$2-D67)*$E$2)		=G66*(1+$G$2)-B67	=(B67-E67)/C67
68	**Total**	**=SUM(B43:B67)**			**=SUM(E43:E67)**			

These spreadsheets are available at **www.mhhe.com/bkm**

The top panel of the sheet deals with the earning years. Column D adjusts the exemption (D2) by the price level (column C). Column E applies the tax rate (cell E2) to taxable income (column B − column D). The savings rate (F2) is applied to after-tax income (column B − column E), allowing us to calculate cumulative savings (column G) and real consumption (column H). The formula view shows the detailed construction.

As you might have expected, real consumption is lower in the presence of taxes, as are savings and the retirement fund. The retirement fund provides for a real, before-tax annuity of only $37,882, compared with $49,668 absent taxes in Spreadsheet 20.2.

The bottom panel of the sheet shows the further reduction in real consumption due to taxes paid during the retirement years. While you do not pay taxes on the cumulative savings in the retirement plan (you did that already as the savings accrued interest), you do pay taxes on interest earned by the fund while you are drawing it down. These taxes are quite significant and further deplete the fund and its net-of-tax earning power. For this reason, your consumption annuity is lower in the early years when your fund has not yet been depleted and earns quite a bit.

In the end, despite a handsome income that grows at a real rate of almost 4%, an aggressive savings rate of 15%, a modest rate of inflation, and a modest tax, you will only be able to achieve a modest (but at least low-risk) real retirement income. This is a reality with which most people must struggle. Whether to sacrifice more of today's standard of living through an increased rate of saving, or take some risk in the form of saving a real annuity and/or invest in a risky portfolio with a higher expected return, is a question of preference and risk tolerance.

One often hears complaints about the double taxation resulting from taxing income earned on savings from dollars on which taxes were already paid. It is interesting to see what effective tax rate is imposed on your lifetime earnings by double taxation. To do so, we use Spreadsheet 20.4 to set up your lifetime earnings, exemptions, and taxes:

Income			
(1)	Lifetime labor income		$7,445,673
	Total exemptions during working years	949,139	
(2)	Lifetime taxable labor income		6,496,534
Taxes			
	During labor years	1,884,163	
	During retirement	203,199	
(3)	Lifetime taxes		2,087,362
Lifetime average tax rate	= (3)/(1)		28%
Lifetime tax rate on taxable income	= (3)/(2)		32%

Thus, double taxation is equivalent to raising the tax rate on taxable income to 32%. It creates a lifetime *average* tax rate (28%) that is higher than the prescribed *marginal* rate of 25%.

CONCEPT check

4. **Would a 1% increase in the exemption compensate you for a 1% increase in the tax rate?**

20.4 THE ECONOMICS OF TAX SHELTERS

tax shelters

Means by which to postpone payment of tax liabilities for as long as possible.

Tax shelters range from the simple to the mind-bogglingly complex, yet they all have one common objective: to postpone payment of tax liabilities for as long as possible. We know already that this isn't small fry. Postponement implies a smaller present value of tax payment, and a tax paid with a long delay can have present value near zero. However, delay is necessarily beneficial only when the tax rate doesn't increase over time. If the tax rate on retirement income is higher than during earning years, the value of a tax deferral may be questionable; if the tax rate will decline, deferral is even more preferable.

A Benchmark Tax Shelter

Postponing tax payments is the only attainable (legal) objective since, whenever you have taxable income, a tax liability is created that can (almost) never be erased.[3] For this reason, a benchmark tax shelter *postpones all* taxes on savings and the income on those savings. In this case, your entire savings account is liable to taxation and will be paid upon retirement, as you draw down the retirement fund. This sort of shelter is actually equivalent to the tax treatment of Individual Retirement Accounts (IRAs) which we discuss later, so we will describe this structure as having an "IRA style."

To examine the impact of an IRA-style structure (assuming you could shelter all your savings) in a situation comparable to the nonsheltered flat-tax case, we maintain the same consumption level as in Spreadsheet 20.4 (flat tax with no shelter), but now input the new,

[3]Bankruptcy or death can erase some tax liabilities, though. We will avoid dealing with these unhappy outcomes.

sheltered savings plan in Spreadsheet 20.5. This focuses the entire effect of the tax shelter onto retirement consumption.

spreadsheet 20.5

Saving with a flat tax and an IRA-style tax shelter

	A	B	C	D	E	F	G	H
1	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax Rate	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**15000**	**0.25**	**0.15**	**0.06**	**0.0291**
3	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
4	30	50,000	1.00	15,000	5,016	9,922	9,922	35,063
5	31	53,500	1.03	15,450	5,465	10,724	21,242	36,224
9	35	70,128	1.16	17,389	7,628	14,600	83,620	41,319
19	45	137,952	1.56	23,370	16,695	31,106	438,234	57,864
29	55	271,372	2.09	31,407	34,952	65,205	1,393,559	81,773
39	65	533,829	2.81	42,208	71,307	135,087	3,762,956	116,365
40	**Total**				**944,536**	**1,773,854**	Real Annuity	**76,052**
41	**RETIREMENT**							
42	Age	Nom Withdraw	Deflator	Exemption	Taxes		Funds Left	rConsumption
43	66	220,420	2.90	43,474	44,236		3,768,313	60,789
47	70	248,085	3.26	48,931	49,789		3,720,867	60,789
52	75	287,598	3.78	56,724	57,719		3,455,127	60,789
57	80	333,405	4.38	65,759	66,912		2,856,737	60,789
62	85	386,508	5.08	76,232	77,569		1,774,517	60,789
67	90	448,068	5.89	88,374	89,924		0	60,789
68	**Total**	**8,036,350**			**1,612,828**			

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	A	B	C	D	E	F	G	H
1	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax Rate	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**15000**	**0.25**	**0.15**	**0.06**	**=(G2-C2)/(1+C2)**
3	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
4	30	50000	1	=$D$2*C4	=(H4*C4-D4)*$E$2	=B4-E4-H4*C4	=F4	35062.5
5	31	=B4*(1+$B$2)	=C4*(1+$C$2)	=$D$2*C5	=(H5*C5-D5)*$E$2	=B5-E5-H5*C5	=G4*(1+$G$2)+F5	36223.7712378641
39	65	=B38*(1+$B$2)	=C38*(1+$C$2)	=$D$2*C39	=(H39*C39-D39)*$E$2	=B39-E39-H39*C39	=G38*(1+$G$2)+F39	116364.9805236 64
40	**Total**				**=SUM(E4:E39)**	**=SUM(F4:F39)**	Real Annuity	**=PMT($H$2,$A$2,-$G$39/$C$39,0,0)**
41	**RETIREMENT**							
42	Age	Nom Withdraw	Deflator	Exemption	Taxes		Funds Left	rConsumption
43	66	=$H$40*C43	=C39*(1+$C$2)	=$D$2*C43	=MAX(0,(B43-D43)*$E$2)		=G39*(1+$G$2)-B43	=(B43-E43)/C43
44	67	=$H$40*C44	=C43*(1+$C$2)	=$D$2*C44	=MAX(0,(B44-D44)*$E$2)		=G43*(1+$G$2)-B44	=(B44-E44)/C44
67	90	=$H$40*C67	=C66*(1+$C$2)	=$D$2*C67	=MAX(0,(B67-D67)*$E$2)		=G66*(1+$G$2)-B67	=(B67-E67)/C67
68	**Total**	**=SUM(B43:B67)**			**=SUM(E43:E67)**			

These spreadsheets are available at **www.mhhe.com/bkm**

In this sheet, we input desired real consumption (column H, copied from Spreadsheet 20.4). Taxes (column E) are then calculated by applying the tax rate (E2) to nominal consumption less the exemption ($H \times C - D$). Thus, savings are the residual from nominal income (B) minus taxes (E), minus nominal consumption ($H \times C$). The retirement panel shows that you pay taxes on all withdrawals—all funds in the retirement account are subject to tax.

The results are interesting. Total lifetime taxes paid with the IRA tax shelter amount to $2.5 million, a lot more than $2.1 million absent the shelter. The reason is that the tax shelter allows for larger savings that increase lifetime income to $3.7 million compared with only $1.9 million absent the shelter. Since in this comparison income and consumption during the earnings years are the same, the entire net gain from the shelter is pushed to the retirement years. Thus, the real annuity (annual consumption) during retirement increases from $37,882 to $76,052.

5. **With the IRA-style tax shelter, all your taxes are due during retirement. Is the tradeoff between exemption and tax rate different from the circumstance where you have no shelter?**

CONCEPT check

The Effect of the Progressive Nature of the Tax Code

Because of the exemption, the flat tax is somewhat progressive: taxes are an increasing fraction of income as income rises. For very high incomes, the marginal tax rate (25%) is only slightly higher than the average rate. For example, with income of $50,000 at the outset, the

average tax rate is 17.5% (.25 × 35,000/50,000), and grows steadily over time. In general, with a flat tax, the ratio of the average to marginal rate equals the ratio of taxable to gross income. This ratio becomes .89 at age 45 (check this) at which point the average tax rate is above 22%. The current U.S. tax code, with multiple income brackets, is much more progressive than our assumed structure.

progressive tax

Taxes are an increasing fraction of income.

In Spreadsheet 20.6 we work with a more **progressive tax** structure that is closer to the U.S. Federal tax code augmented with an average state tax. Our hypothetical tax schedule is described in Table 20.1.

spreadsheet 20.6

Saving with a progressive tax

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	A	B	C	D	E	F	G	H
1	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax rates in	Savings Rate	ROR	rROR
2	25	0.07	0.03	10000	Table 18.1	0.15	0.06	0.0291
3	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
4	30	50,000	1.00	10,000	8,000	6,300	6,300	35,700
5	31	53,500	1.03	10,300	8,716	6,718	13,396	36,958
9	35	70,128	1.16	11,593	12,489	8,646	51,310	42,262
19	45	137,952	1.56	15,580	32,866	15,763	248,018	57,333
29	55	271,372	2.09	20,938	76,587	29,218	731,514	79,076
39	65	533,829	2.81	28,139	186,335	52,124	1,833,644	104,970
40	**Total**		Total	**632,759**	**2,116,533**	**799,371**	**Real Annuity**	**37,059**
41	**RETIREMENT**							
42	Age	Nom Withdraw	Deflator	Exemption	Taxes		Fund Left	rConsumption
43	66	107,408	2.90	28,983	16,207		1,836,254	31,467
47	70	120,889	3.26	32,620	15,371		1,813,134	32,347
52	75	140,143	3.78	37,816	13,083		1,683,643	33,599
57	80	162,464	4.38	43,839	8,831		1,392,054	35,045
62	85	188,341	5.08	50,821	1,757		864,701	36,714
67	90	218,338	5.89	58,916	0		0	37,059
68	**Total**	**3,916,018**			**227,675**			

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Spreadsheet 20.6 is identical to Spreadsheet 20.4, the only difference being the tax built into column E according to the schedule in Table 20.1.

Despite the more progressive schedule of this tax code, at the income level we assume, you would end up with a similar standard of living. This is due to the large lower-rate bracket. The early increased savings offset some of the bite of the overall higher tax rate. Another important result of the nature of this code is the lower marginal tax rate upon retirement when taxable income is lower. This is the environment in which a tax shelter is most effective, as we shall soon see.

Spreadsheet 20.7 augments the progressive tax code with our benchmark (IRA-style) tax shelter that allows you to pay taxes on consumption (minus an exemption) and accumulate tax liability to be paid during your retirement years. The construction of this spreadsheet is identical to Spreadsheet 20.5, with the only difference being the tax structure built into column E. We copied the real preretirement consumption stream from Spreadsheet 20.6 to focus the effect of the tax shelter on the standard of living during the retirement years. Spreadsheet 20.7 shows that the lower tax bracket during the retirement years allows you to pay lower taxes over the life of the plan and significantly increases retirement consumption. The use of the IRA-style tax shelter increases the retirement annuity by an average of $32,000 a year, a better improvement than we obtained from the shelter with the flat tax.

table 20.1

Income tax schedule used for the progressive tax

Taxable Income* Over	But Not Over	The Tax Is	of the Amount Over
$ 0	$ 50,000	$ 0 + 20%	$ 0
50,000	150,000	10,000 + 30	50,000
150,000	. . .	40,000 + 40	150,000

*Current exemption with this code is assumed to be $10,000. The exemption and tax brackets are adjusted for future inflation.

spreadsheet 20.7

The benchmark (IRA) tax shelter with a progressive tax code

	A	B	C	D	E	F	G	H
1	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax rates in	Savings Rate	ROR	rROR
2	**25**	**0.07**	**0.03**	**10000**	**Table 18.1**	**0.15**	**0.06**	**0.0291**
3	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
4	30	50,000	1.00	10,000	5,140	9,160	9,160	35,700
5	31	53,500	1.03	10,300	5,553	9,880	19,590	36,958
9	35	70,128	1.16	11,593	7,480	13,654	77,112	42,262
19	45	137,952	1.56	15,580	14,749	33,880	434,916	57,333
29	55	271,372	2.09	20,938	32,920	72,885	1,455,451	79,076
39	65	533,829	2.81	28,139	66,100	172,359	4,125,524	104,970
40	**Total**			**632,759**	**879,430**	**2,036,474**	Real Annuity	**83,380**
41	**RETIREMENT**							
42	Age	Nom Withdraw	Deflator	Exemption	Taxes		Funds Left	rConsumption
43	66	241,658	2.90	28,983	49,311		4,131,398	66,366
47	70	271,988	3.26	32,620	55,500		4,079,381	66,366
52	75	315,309	3.78	37,816	64,340		3,788,036	66,366
57	80	365,529	4.38	43,839	74,588		3,131,989	66,366
62	85	423,749	5.08	50,821	86,467		1,945,496	66,366
67	90	491,241	5.89	58,916	100,239		0	66,366
68	**Total**	**8,810,670**	**Total**		**1,797,848**			

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The effectiveness of the shelter also has a sort of hedge quality. If you become fortunate and strike it rich, the tax shelter will be less effective, since your tax bracket will be higher at retirement. However, mediocre or worse outcomes will result in low marginal rates upon retirement, making the shelter more effective and the tax bite lower.

6. Are you indifferent between an increase in the low-income bracket tax rate versus an equal increase in the high bracket tax rates?

CONCEPT check

20.5 A MENU OF TAX SHELTERS

Individual Retirement Accounts

Individual Retirement Accounts (IRAs) were set up by Congress to increase the incentives to save for retirement. The limited scope of these accounts is an important feature. Currently, annual contributions are limited to $4,000 in tax years 2005–2006 and then $5,000 afterward. Workers 50 years of age and up can increase annual contributions by up to another $1,000. IRAs are somewhat illiquid (as are most shelters), in that there is a 10% penalty on withdrawals prior to age 59½. However, allowances for early withdrawal with no penalty for qualified reasons such as (one-time) purchase of a home or higher education expenses substantially mitigate the problem.

There are two types of IRAs to choose from; the better alternative is not easy to determine.

Traditional IRA Contributions to **traditional IRA** accounts are tax deductible, as are the earnings until retirement. In principle, if you were able to contribute all your savings to a traditional IRA, your savings plan would be identical to our benchmark tax shelter (Spreadsheets 20.5 and 20.7), with the effectiveness of tax mitigation depending on your marginal tax rate upon retirement.

traditional IRA

Contributions to the account and investment earnings are tax sheltered until retirement.

Roth IRA A **Roth IRA** is a variation on the traditional IRA tax shelter, with both a drawback and an advantage. Contributions to Roth IRAs are *not* tax deductible. However, earnings on the accumulating funds in the Roth account are tax-free, and unlike a traditional IRA, no taxes are paid upon withdrawals of savings during retirement. The trade-off is not easy to evaluate. To gain insight and illustrate how to analyze the trade-off, we contrast Roth with traditional IRAs under our two alternative tax codes.

Roth IRA

Contributions are not tax sheltered, but investment earnings are tax free.

Roth IRA with the Progressive Tax Code

As we have noted, a traditional IRA is identical to the benchmark tax shelter set up under two alternative tax codes in Spreadsheets 20.5 and 20.7. We saw that, as a general rule, the effectiveness of a tax shelter depends on the progressivity of the tax code: lower tax rates during retirement favor the postponement of tax obligations until one's retirement years. However, with a Roth IRA, you pay no taxes at all on withdrawals during the retirement phase. In this case, therefore, the effectiveness of the shelter does not depend on the tax rates during the retirement years. The question for any investor is whether this advantage is sufficient to compensate for the nondeductibility of contributions, which is the primary advantage of the traditional IRA.

To evaluate the trade-off, Spreadsheet 20.8 modifies Spreadsheet 20.7 (progressive tax) to conform to the features of a Roth IRA, that is, we eliminate deductibility of contributions and taxes during the retirement phase. We keep consumption during the earning years the same as they were in the benchmark (traditional IRA) tax shelter to compare the standard of living in retirement afforded by a Roth IRA tax shelter.

spreadsheet 20.8

Roth IRA with a progressive tax

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	A	B	C	D	E	F	G	H
3	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax Rates in	Savings Rate	ROR	rROR
4	**25**	**0.07**	**0.03**	**10000**	**Table 20.1**	**0.15**	**0.06**	**0.0291**
5	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
6	30	50,000	1.00	10,000	8,000	6,300	6,300	35,700
7	31	53,500	1.03	10,300	8,640	6,793	13,471	36,958
11	35	70,128	1.16	11,593	11,764	9,370	52,995	42,262
21	45	137,952	1.56	15,580	28,922	19,707	278,528	57,333
31	55	271,372	2.09	20,938	64,661	41,143	883,393	79,076
41	65	533,829	2.81	28,139	145,999	92,460	2,432,049	104,970
42	**Total**	**7,445,673**		**632,759**	**1,752,425**	**1,163,478**	Real Annuity	**49,153**
43	**RETIREMENT**							
44	Age	Nom Withdraw	Deflator	Exemption	Taxes		Funds Left	rConsumption
45	66	142,460	2.90	28,983	0		2,435,512	49,153
49	70	160,340	3.26	32,620	0		2,404,847	49,153
54	75	185,879	3.78	37,816	0		2,233,096	49,153
59	80	215,484	4.38	43,839	0		1,846,348	49,153
64	85	249,805	5.08	50,821	0		1,146,895	49,153
69	90	289,593	5.89	58,916	0		0	49,153
70	**Total**	**5,194,003**			**0**			

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Table 20.2 demonstrates the difference between the two types of shelters. In both cases, lifetime income and real consumption during the earning years, as well as the progressive tax scheme, are identical. The only difference is which IRA plan you choose, traditional or Roth. Hence the first line of Table 20.2, lifetime labor income, is fixed at $7.4 million. But the shelter works differently in each case. The traditional IRA shelters more income during the earning years, resulting in total taxes of only $879,430, compared with $1.75 million under the

table 20.2

Traditional vs. Roth IRA tax shelters under a progressive tax code

	Traditional IRA	Roth IRA
Lifetime labor income	**$7,445,673**	**$7,445,673**
Taxes ($)		
Earning years	$ 879,430	$1,752,425
Retirement years	1,797,848	0
Total paid over lifetime	**2,677,278**	**1,752,425**
Lifetime average tax rate (%)	35.96%	23.54%
Retirement annuity:		
Before-tax	$83,380	$49,153
After-tax	66,366	49,153

Roth IRA. In the retirement years, however, the Roth IRA plan entails no taxes, while the traditional IRA results in taxes of just under $1.8 million. Lifetime taxes are $2.7 million using the traditional IRA compared with only $1.75 million for the Roth IRA. Despite this, the larger accumulation in the traditional IRA saving account results in a larger retirement fund ($4.1 million compared with $2.4 million) and a larger real after-tax retirement annuity of $66,366. The bottom line is that the traditional IRA is more effective for the middle-income family we examine here.

The explanation of why the traditional IRA is better for a middle-income family also indicates when the Roth IRA may be preferred. If earnings are sharply back-loaded, that is, most of your earnings are close to retirement, then tax-free accumulation of investment income is less important, and the Roth IRA may dominate. This can happen if you start with fewer years to retirement and your income grows faster. Without changing the number of years to retirement, you would need to change nominal income growth in both spreadsheets from 7% to an extreme 40% for the Roth IRA to dominate. (The Web site **www.quicken.com** allows you to make the comparison for private circumstances.)

Notice in Table 20.2 that the lifetime average tax rate for saving with traditional IRAs is 35.96%. This is a result of large accumulation of earnings on savings that are taxed on retirement and shows the importance of early accumulation. Despite the higher lifetime taxes, this tax shelter ends up with larger after-tax real consumption during retirement.

7. Suppose all taxpayers were like you, and the IRS wished to raise a fixed tax revenue. Would it be wise to offer the Roth IRA option?

CONCEPT *check*

401k and 403b Plans

These days the majority of employees receive retirement benefits in the form of a defined contribution plan (see Chapter 21 for more discussion of these plans). These are named after the relevant sections of the U.S. tax code: 401k in the corporate sector and 403b in the public and tax-exempt sectors. These are quite similar and the discussion of 401k plans applies to 403b plans as well.

401k plans have two distinct features. First and foremost, your employer may match your contribution to various degrees, up to a certain level. This means that if you elect not to participate in the plan, you forgo part of your potential employment compensation. Needless to say, regardless of tax considerations, any employee should contribute to the plan at least as much as the employer will match, except for extreme circumstances of cash needs. While some employees may face cash constraints and think they would be better off skipping contributions, in many circumstances, they would be better off borrowing to bridge the liquidity shortfall while continuing to contribute up to the level matched by the employer.

401k plans

Defined employee contribution plans wherein the employer matches the employee's contribution up to a set percentage.

The second feature of the plan is akin to a traditional IRA in tax treatment and similar in other restrictions. Contributions to 401k plans are restricted (details can be found on many Web sites, e.g., **www.Morningstar.com**), but the limits on contributions generally exceed the level matched by the employer. Hence you must decide how much of your salary to contribute beyond the level matched by your employer. You can incorporate 401k plans, like the traditional IRA, in your savings-plan spreadsheet, review the trade-off, and make an informed decision on how much to save.

Risky Investments and Capital Gains as Tax Shelters

So far we have limited our discussion to safe investments that yield a sure 6%. This number, coupled with the inflation assumption (3%), determined the results of various savings rules under the appropriate tax configuration. You must recognize, however, that the 6% return and 3% inflation are not hard numbers and consider the implications of other possible scenarios over the life of the savings plan. The spreadsheets we developed make scenario analysis quite easy. Once you set up a spreadsheet with a contemplated savings plan, you simply vary the

inputs for ROR (the nominal rate of return) and inflation and record the implications for each scenario. The probabilities of possible deviations from the expected numbers and your risk tolerance will dictate which savings plan provides you with sufficient security of obtaining your goals. This sensitivity analysis will be even more important when you consider risky investments.

The tax shelters we have described allow you to invest in a broad array of securities and mutual funds and you can invest your nonsheltered savings in anything you please. Which portfolio to choose is a matter of risk versus return. That said, taxes lend importance to the otherwise largely irrelevant aspect of dividends versus capital gains.

According to current U.S. tax law, there are two applicable capital gains rates for most investments: 15% if your marginal tax rate is higher than 25%, and 5%[4] if you are in a lower tax bracket. More importantly, you pay the applicable rate only when you sell the security. Thus, investing in nondividend-paying securities is an automatic partial tax shelter with no restrictions on contributions or withdrawals. Because this investment is not tax deductible, it is similar to a Roth IRA, but somewhat inferior in that you do pay a tax on withdrawal, however low. Still, such investments can be more effective than traditional IRA and 401k plans, as we discussed earlier. Since annual contributions to all IRAs and 401k plans are quite limited, investment in a low- or no-dividend portfolio may be the efficient shelter for many investors who wish to exceed the contribution limit. Another advantage of such portfolios is that you can sell those securities that have lost value to realize capital losses and thereby reduce your tax bill in any given year. This virtue of risky securities is called the *tax-timing option.* Managing a portfolio with efficient utilization of the tax-timing option requires expert attention, however, and may not be appropriate for many savers.

The average dividend yield on the S&P 500 stocks is on the order of 2%, and other indexes (such as Nasdaq) bear an even lower yield. This means that you can easily construct a well-diversified portfolio with a very low dividend yield. Such a portfolio allows you to utilize the tax advantage of capital gains versus dividends. Spreadsheet 20.9 adapts Spreadsheet 20.6 (progressive tax with no shelter) to a no-dividend portfolio of stocks, maintaining the same preretirement consumption stream, holding the ROR at 6% and assuming 15% capital gains tax. Real retirement consumption, averaging $45,105, is almost identical to that supported by a Roth IRA (Spreadsheet 20.8).[5]

spreadsheet 20.9

Saving with no-dividend stocks under a progressive tax

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	A	B	C	D	E	F	G	H
3	Retirement Years	Income Growth	Rate of Inflation	Exemption Now	Tax rates in	Savings Rate	ROR	rROR
4	**25**	**0.07**	**0.03**	**10000**	**Table 20.1**	**0.15**	**0.06**	**0.0291**
5	Age	Income	Deflator	Exemption	Taxes	Savings	Cumulative Savings	rConsumption
6	30	50,000	1.00	10,000	8,000	6,300	6,300	35,700
7	31	53,500	1.03	10,300	8,640	6,793	13,471	36,958
11	35	70,128	1.16	11,593	11,764	9,370	52,995	42,262
21	45	137,952	1.56	15,580	28,922	19,707	278,528	57,333
31	55	271,372	2.09	20,938	64,661	41,143	883,393	79,076
41	65	533,829	2.81	28,139	145,999	92,460	2,432,049	104,970
42	**Total**				**1,752,425**	**1,163,478**	**Real Annuity**	**49,153**
43	**RETIREMENT**				Tax rate on	capital gains	**0.15**	
44	Age	Nom Withdraw	Deflator	Cum cap gains	Exemption	Taxes	Funds Left	rConsumption
45	66	142,460	2.90	1,340,186	28,983	6,799	2,435,512	46,808
49	70	160,340	3.26	1,561,124	32,620	10,178	2,404,847	46,033
54	75	185,879	3.78	1,660,844	37,816	14,598	2,233,096	45,293
59	80	215,484	4.38	1,503,386	43,839	19,338	1,846,348	44,742
64	85	249,805	5.08	995,489	50,821	24,535	1,146,895	44,326
69	90	289,593	5.89	1,500	58,916	30,626	0	43,955
70	**Total**				**1,056,691**	**445,850**		

This spreadsheet is available at **www.mhhe.com/bkm**

[4]The rate goes up to 10% if you hold the security for less than five years.

[5]In Spreadsheet 20.9 we did not take full advantage of the tax code. You can defer capital gains longer by accounting for the shares you sell so that you sell first new shares with little capital gains and old shares last.

table 20.3
Investing Roth IRA contributions in stocks and bonds

Phase	Asset	Stocks Inside; Bonds Outside	Stocks Outside; Bonds Inside
Savings	Bonds	Taxed upon accrual	No taxes
	Stocks	No taxes	Taxes deferred
Withdrawal	Bonds	No taxes	No taxes
	Stocks	No taxes	Taxed at capital gains rate

table 20.4
Investing traditional IRA or 401k contributions in stocks and bonds

Phase	Asset	Stocks Inside; Bonds Outside	Stocks Outside; Bonds Inside
Savings	Bonds	Taxed on accrual	Taxes deferred
	Stocks	Tax deferred	Taxes deferred
Withdrawal	Bonds	No taxes	Taxed at marginal rate
	Stocks	Taxed at marginal rate	Taxed at capital gains rate

Sheltered versus Unsheltered Savings

Suppose your desired level of savings is double the amount allowed in IRAs and 401k (or 403b) plans. At the same time you wish to invest equal amounts in stocks and bonds. Where should you keep the stocks and where the bonds? You will be surprised to know how many investors make the costly mistake of holding the stocks in a tax-protected account and the bonds in an unsheltered account. This is a mistake because most of the return from bonds is in the form of taxable interest payments, while stocks by their nature already provide some tax shelter.

Recall that tax shelters enhance the retirement annuity with two elements: (1) tax deferral on contributions and (2) tax deferral on income earned on savings. The effectiveness of each element depends on the tax rate on withdrawals. Of the two types of tax shelters we analyzed, traditional IRA and 401k (or 403b) plans contain both elements, while a Roth IRA provides only the second, but with the advantage that the tax rate on withdrawals is zero. Therefore, we need to analyze the stock–bond shelter question separately for each type of retirement plan. Table 20.3 shows the hierarchy of this analysis when a Roth IRA is used. The difference is apparent by comparing the taxes in each column. With stocks inside and bonds outside the shelter you pay taxes early and at the ordinary income rate. When you remove stocks from and move bonds into the shelter you pay taxes later at the lower capital gains rate.

When you use either a traditional IRA or 401k plan, contributions are tax deferred regardless of whether you purchase stocks or bonds, so we need to compare only taxes on income from savings and withdrawal. Table 20.4 shows the trade-off for a traditional IRA or 401k plan.

The advantage ends up being the same as with the Roth IRA. By removing stocks from and moving bonds into the shelter you gain the deferral on the bond interest during the savings phase. During the retirement phase you gain the difference between the ordinary income and the capital gains rate on the gains from the stocks.

8. **Does the rationale of sheltering bonds rather than stocks apply to preferred stocks?**

CONCEPT *check*

Social Security

Federally mandated pension plan established to provide minimum retirement benefits to all workers.

20.6 SOCIAL SECURITY

Social Security (SS) is a cross between a pension and an insurance plan. It is quite regressive in the way it is financed, in that employees pay a proportional (currently 7.65%) tax on gross

wages, with no exemption but with an income cap ($90,000 for 2005). Employers match employees' contributions and pay SS directly.[6]

On the other hand, SS is progressive in the way it allocates benefits; low-income individuals receive a relatively larger share of preretirement income upon retirement. Of the SS tax of 7.65%, 6.2% goes toward the retirement benefit and 1.45% toward retirement healthcare services provided by Medicare. Thus, combining your payments with your employer's, the real retirement annuity is financed by $2 \times 6.2 = 12.4\%$ of your income (up to the aforementioned cap); we do not examine the Medicare component of SS in this chapter.

SS payments are made throughout one's entire working life; however, only 35 years of contributions count for the determination of benefits. Benefits are in the form of a lifetime real annuity based on a retirement age of 65, although you can retire earlier (as of age 62) or later (up to age 70) and draw a smaller or larger annuity, respectively. One reason SS is projected to face fiscal difficulties in future years is the increased longevity of the population. The current plan to mitigate this problem is to gradually increase the retirement age.

Calculation of benefits for individuals retiring in a given year is done in four steps:

1. The series of your taxed annual earnings (using the cap) is compiled. The status of this series is shown in your annual SS statement.
2. An indexing factor series is compiled for all past years. This series is used to account for the time value of your lifetime contributions.
3. The indexing factors are applied to your recorded earnings to arrive at the Average Indexed Monthly Earnings (AIME).
4. Your AIME is used to determine the Primary Insurance Amount (PIA), which is your monthly retirement annuity.

All this sounds more difficult than it really is, so let's describe steps 2 through 4 in detail.

The Indexing Factor Series

Suppose your first wage on which you paid the SS tax was earned 40 years ago. To arrive at today's value of this wage, we must calculate its future value over the 40 years, that is, $\text{FV} = \text{wage} \times (1 + g)^{40}$. The SS administration refers to this as the indexed earnings for that year, and the FV factor, $(1 + g)^{40}$, is the index for that year. This calculation is made for each year, resulting in a series of indexed earnings which, when summed, is the value today of the entire stream of lifetime taxed earnings.

A major issue is what rate, g, to use in producing the index for each year. SS uses for each year the growth in the average wage of the U.S. working population in that year. Arbitrarily, the index for the most recent two years is set to 1.0 (a growth rate of zero) and then increased each year, going backward, by the growth rate of wages in that year. For example, in the year 2001 the index for 1967 (35 years earlier) was 6.16768. Thus the 1967 wage is assumed to have been invested for 35 years at 5.34% ($1.0534^{35} = 6.16768$). The actual average growth rate of wages in the U.S. over the years 1967–2001 was 5.48%;[7] the index is slightly lower because the growth rate in the two most recent years prior to retirement has been set to zero.

Wage growth was not constant over these years. For example, it was as high as 10.07% in 1980–1981, and as low as 0.86% in 1992–1993. At the same time, the (geometric) average T-bill rate over the years 1967–2001 was 6.53% and the rate of inflation 4.92%, implying a real interest rate of 1.53%. For retirees of 2002, the average *real* growth rate applied to their SS contributions was about 0.40% (depending on how much they contributed in each year), significantly lower than the real interest rate over their working years, but closer to the longer-term (1926–2003) real rate of 0.73%. (See Table 5.3).

[6]Absent the SS tax, it is reasonable to assume that the amount contributed by employers would be added to your pretax income, hence your actual contribution is really 15.3%. For this reason, self-employed individuals are required to contribute 15.3% to SS.

[7]We use a wage growth rate of 7% in our exercises, assuming our readers are well educated and can expect a higher than average growth. Special attention must be given to this input (and the others) if you advise other people.

table 20.5

Calculation of the retirement annuity of representative retirees of 2005

AIME Rank	Low	Average	High	Maximum
% of average wage	50	100	150	Max*
AIME ($ month)	1,400	2,800	4,200	5,800
PIA formula:				
90% of the first $592	533	533	533	533
32% of AIME over $592 through $3,567	259	707	952	952
15% of AIME over $3,567	0	0	95	335
Total = PIA ($/month)	791	1,239	1,580	1,820
Real retirement annuity = PIA × 12	9,496	14,872	18,957	21,837
Income replacement (%)	56.5%	44.3%	37.6%	NA*
IRR** assuming longevity = 81; Inflation = 3%	6.52	5.51	4.83	3.82
IRR** assuming longevity = 84; Inflation = 3%	7.02	6.06	5.41	4.51
Longevity implied by SS (years) for IRR = 6%	14	19	23	30

*Income is above the maximum taxable and income replacement cannot be calculated.

**Internal Rate of Return.

The Average Indexed Monthly Income

The series of a retiree's lifetime indexed contributions (there may be zeros in the series for periods when the retiree was unemployed) is used to determine the base for the retirement annuity. The 35 highest indexed contributions are identified, summed, and then divided by $35 \times 12 = 420$ to achieve your Average Indexed Monthly Income (AIME). If you worked less than 35 years, all your indexed earnings will be summed, but your AIME might be low since you still divide the sum by 420. If you worked more than 35 years, only the 35 highest indexed wages will be used to compute the average.

The Primary Insurance Amount

In this stage of the calculation of monthly SS benefits, low-income workers (with a low AIME) are favored in order to increase income equality. The exact formula may change from one year to the next, but the example of four representative individuals who retired in 2005 demonstrates the principle. The AIME of these individuals relative to the average in the population and their Primary Insurance Amount (PIA) are calculated in Table 20.5.

Table 20.5 presents the value of SS to U.S. employees who retired in 2005. The first part of the table shows how SS calculates the real annuity to be paid to retirees.[8] The results differ for the four representative individuals. One measure of this differential is the *income replacement rate* (i.e., retirement income as a percent of working income) provided to the four income brackets in Table 20.5. Low-income retirees have a replacement rate of 56.5%, more than 1.5 times that of the high-wage employees (37.6%).

The net after-tax benefits may be reduced if the individual has other sources of income, because a portion of the retirement annuity is subject to income tax. Currently, retired households with combined taxable income over $32,000 pay taxes on a portion of the SS benefits. At income of $44,000, 50% of the SS annuity is subject to tax and the proportion reaches 85% at higher income. You can find the current numbers and replicate the calculations in Table 20.5 by logging on to **www.ssa.gov/OACT/ProgData/nominalEarn.html**. This Web site also allows you to project Social Security benefits at various levels of sophistication.

When evaluating the attractiveness of SS as an investment for current retirees (the bottom part of Table 20.5), we must consider current **longevity** figures. For a male, current remaining life expectancy at age 65 is an additional 15.6 years, and for a female 19.2 years. Using these

longevity

Remaining life expectancy.

[8]The annuity of special-circumstance low-income retirees is supplemented.

figures, the current PIA provides male retirees an internal rate of return on SS contributions in the range of 6.52–3.82%, and female retirees 7.02–4.51%.[9] These IRRs are obtained by taking 12.4% (the combined SS tax) of the series of 35 annual earnings of the four employees as cash outflows. The series of annuity payments (16 years for males and 19 for females), assuming inflation at 3%, is used to compute cash inflows.

To examine SS performance another way, the last line in the table shows the longevity (number of payments) required to achieve an IRR of 6%. Except for the highest income bracket, all have life expectancy greater than this threshold. Why are these numbers so attractive, when SS is so often criticized for poor investment performance? The reason benefits are so generous is that the PIA formula sets a high replacement rate relative to the SS tax rate, the proportion of income taxed. Taking history as a guide, to achieve an IRR equal to the rate of inflation plus the historical average rate on a safe investment such as T-bills (with a historical real rate of 0.7%), the formula would need to incorporate a lower replacement rate. With a future rate of inflation of 3%, this would imply a nominal IRR of 3.7%. Is the ROR assumed in our spreadsheets (6%) the right one to use, or is the expected IRR based on past real rates the correct one to use? In short, we simply don't know. But averaging across the population, SS may well be a fair pension plan, taking into consideration its role in promoting equality of income.

The solvency of SS is threatened by two factors: population longevity and a below-replacement growth of the U.S. population. Over the next 35 years, longevity is expected to increase by almost two years, increasing steady-state expenditures by more than 10%. To keep a level population (ignoring immigration) requires an average of 2.1 children per female, yet the current average of 1.9 is expected to decline further.[10] The projected large deficit, beginning in 2016, requires reform of SS. Increasing the retirement age to account for increased longevity does not constitute a reduction in the plan's IRR and therefore seems a reasonable solution to deficits arising from this factor. Eliminating the deficit resulting from population decline is more difficult. It is projected that doing so by increasing the SS tax may require an increase in the combined SS tax of as much as 10% within your working years. Such a simple solution is considered politically unacceptable, so you must expect changes in benefits.

The question of privatizing a portion of SS so that investors will be able to choose portfolios with risk levels according to their personal risk tolerance has become a hot public policy issue. Clearly, the current format that provides a guaranteed real rate is tailored to individuals with low risk tolerance. Although we advocate that at least a portion of SS be considered as a safety-first proposition (with a very low-risk profile), investors who are willing to monitor and rebalance risky portfolios cannot be faulted for investing in stocks. The main point with respect to this option is that the media and even some finance experts claim that a long-term investment in stocks is not all that risky. We cannot disagree more. We project that with appropriate risk adjustment, future retirees will find it difficult to beat the SS plan and should be made fully aware of this fact.[11]

9. Should you consider a dollar of future Social Security benefits as valuable as a dollar of your projected retirement annuity? For example, suppose your target is a real annuity of $100,000 and you project your SS annuity at $20,000. Should you save to produce a real annuity of $80,000?

[9]However, income is correlated with longevity and with durability of marriage. This means that wealthy retirees and their spouses draw longer annuities than the poor do. It is suggested that this difference may as much as completely offset the progressivity built into the PIA schedule.

[10]Fertility rates in Europe, Japan, and (until recently) in China are even lower, exacerbating the problems of their Social Security systems.

[11]Here, again, we collide with those who consider stocks low-risk investments in the long run (some of them esteemed colleagues). One cannot overestimate the misleading nature of this assessment (see the Appendix to Chapter 6).

20.7 CHILDREN'S EDUCATION AND LARGE PURCHASES

Sending a child to a private college can cost a family in excess of $40,000 a year, in current dollars, for four years. Even a state college can cost in excess of $25,000 a year. Many families will send two or more children to college within a few years, creating a need to finance large expenditures within a few years. Other large expenditures such as a second home (we deal with the primary residence in the next section) or an expensive vehicle present similar problems on a smaller scale.

The question is whether planned, large outflows during the working years require a major innovation to our planning tools. The answer is no. All you need to do is add a column to your spreadsheet for extra-consumption expenditures that come out of savings. As long as cumulative savings do not turn negative as the outflows take place, the only effect to consider is the reduction in the retirement annuity that results from these expenditures. To respond to a lower-than-desired retirement annuity you have four options: (1) increase the savings rate, (2) live with a smaller retirement annuity, (3) do away with or reduce the magnitude of the expenditure item, or (4) increase expected ROR by taking on more risk. Recall though, that in Section 20.2, we suggested option 4 isn't viable for many investors.

The situation is a little more complicated when the extra-consumption expenditures create negative savings in the retirement plan. In principle, one can simply borrow to finance these expenditures with debt (as is common for large purchases such as automobiles). Again, the primary variable of interest is the retirement annuity. The problem, however, is that if you arrive at a negative savings level quite late in your savings plan, you will be betting the farm on the success of the plan in later years. Recalling, again, the discussion of Section 20.2, the risk in later years, other things being equal, is more ominous since you will have little time to recover from any setbacks.

An illuminating example requires adding only one column to Spreadsheet 20.2, as shown in Spreadsheet 20.10. Column G adds the extra-consumption expenditures. We use as input (cell G2) the current cost of one college year per child—$40,000. We assume your first child will be college-bound when you are 48 years old and the second when you are 50. The expenditures in column G are inflated by the price level in column C and subtracted from cumulative savings in column E.

spreadsheet 20.10

Financing children's education

	A	B	C	D	E	F	G
1	Retirement Years	Income Growth	Rate of Inflation	Savings Rate	ROR	rROR	Extra-Cons
2	**25**	**0.07**	**0.03**	**0.15**	**0.06**	**0.0291**	**40,000**
3	Age	Income	Deflator	Savings	Cumulative Savings	rConsumption	Expenditures
4	30	50,000	1.00	7,500	7,500	42,500	0
5	31	53,500	1.03	8,025	15,975	44,150	0
9	35	70,128	1.16	10,519	61,658	51,419	0
19	45	137,952	1.56	20,693	308,859	75,264	0
22	48	168,997	1.70	25,349	375,099	84,378	68,097
23	49	180,826	1.75	27,124	354,588	87,654	70,140
24	50	193,484	1.81	29,023	260,397	91,058	144,489
25	51	207,028	1.86	31,054	158,252	94,595	148,824
26	52	221,520	1.92	33,228	124,331	98,268	76,644
27	53	237,026	1.97	35,554	88,401	102,084	78,943
28	54	253,618	2.03	38,043	131,748	106,049	0
29	55	271,372	2.09	40,706	180,359	110,167	0
39	65	533,829	2.81	80,074	1,090,888	161,257	0
40	**Total**			**1,116,851**	**Real Annuity**	**22,048**	

This spreadsheet is available at **www.mhhe.com/bkm**

eXcel

Please visit us at www.mhhe.com/bkm

The real retirement annuity prior to this extra-consumption expenditure was $49,688, but "after-children" only $22,048, less than half. The expenditure of $320,000 in today's dollars cost you total lifetime real consumption of $25 \times (\$49{,}688 - \$22{,}048) = \$690{,}514$ because of the loss of interest on the funds that would have been saved. If you change the input in G2 to

$25,000 (reflecting the cost of a public college), the retirement annuity falls to $32,405, a loss of "only" 35% in the standard of living.

CONCEPT check

10. What if anything should you do about the risk of rapid increase in college tuition?

20.8 HOME OWNERSHIP: THE RENT-VERSUS-BUY DECISION

Most people dream of owning a home and for good reason. In addition to the natural desire for roots that goes with owning your home, this investment is an important hedge for most families. Dwelling is the largest long-term consumption item and fluctuations in the cost of dwelling are responsible for the largest consumption risk they face. Dwelling costs, in turn, are subject to general price inflation, as well as to significant fluctuations specific to geographic location. This combination makes it difficult to hedge the risk with investments in securities. In addition, the law favors home ownership in a number of ways, chief of which is tax deductibility of mortgage interest.

Common (though not necessarily correct) belief is that the mortgage tax break is the major reason for investing in rather than renting a home. In competitive markets, though, rents will reflect the mortgage tax-deduction that applies to rental residence as well. Moreover, homes are illiquid assets and transaction costs in buying/selling a house are high. Therefore, purchasing a home that isn't expected to be a long-term residence for the owner may well be a speculative investment with inferior expected returns. The right time for investing in your home is when you are ready to settle someplace for the long haul. Speculative investments in real estate ought to be made in a portfolio context through instruments such as Real Estate Investment Trusts (REITs).

With all this in mind, it is evident that investment in a home enters the savings plan in two ways. First, during the working years the cash down payment should be treated just like any other large extra-consumption expenditure as discussed earlier. Second, home ownership affects your retirement plan because if you own your home free and clear by the time you retire, you will need a smaller annuity to get by; moreover, the value of the house is part of retirement wealth.

CONCEPT check

11. Should you have any preference for fixed versus variable rate mortgages?

20.9 UNCERTAIN LONGEVITY AND OTHER CONTINGENCIES

Perhaps the most daunting uncertainty in our life is the time it will end. Most people consider this uncertainty a blessing, yet, blessing or curse, this uncertainty has economic implications. Old age is hard enough without worrying about expenses. Yet the amount of money you may need is at least linear in longevity, if not exponential. Not knowing how much you will need, plus a healthy degree of risk aversion, would require us to save a lot more than necessary just to insure against the fortune of longevity.

life annuity

An annuity that pays you income until you die.

One solution to this problem is to invest in a life annuity to supplement Social Security benefits, your base life annuity. When you own a **life annuity** (an annuity that pays you income until you die), the provider takes on the risk of the time of death. To survive, the provider must be sure to earn a rate of return commensurate with the risk. Except for wars and

natural disasters, however, an individual's time of death is a unique, nonsystematic risk.[12] It would appear, then, that the cost of a life annuity should be a simple calculation of interest rates applied to life expectancy from mortality tables. Unfortunately, adverse selection comes in the way.

Adverse selection is the tendency for any proposed contract (deal) to attract the type of party who would make the contract (deal) a losing proposition to the offering party. A good example of adverse selection arises in health care. Suppose that Blue Cross offers health coverage where you choose your doctor and Blue Cross pays 80% of the costs. Suppose another HMO covers 100% of the cost and charges only a nominal fee per treatment. If HMOs were to price the services on the basis of a survey of the average health care needs in the population at large, they would be in for an unpleasant surprise. People who need frequent and expensive care would prefer the HMO over Blue Cross. The adverse selection in this case is that high-need individuals will choose the plan that provides more complete coverage. The individuals that the HMO most wants *not* to insure are most likely to sign up for coverage. Hence, to stay in business HMOs must expect their patients to have greater than average needs, and price the policy on this basis.

adverse selection

The tendency for any proposed deal to attract the type of party who would make the deal a losing proposition to the offering party.

Providers of life annuities can expect a good dose of adverse selection as well, as people with the longest life expectancies will be their most enthusiastic customers. Therefore, it is advantageous to acquire these annuities at a younger age, before individuals are likely to know much about their personal life expectancies. The SS trust does not face adverse selection since virtually the entire population is forced into the purchase, allowing it to be a fair deal on both sides.

Unfortunately we also must consider untimely death or disability during the working years. These require an appropriate amount of life and disability insurance, particularly in the early stage of the savings plan. The appropriate coverage should be thought of in the context of a retirement annuity. Coverage should replace at least the most essential part of the retirement annuity.

Finally, there is the need to hedge labor income. Since you cannot insure wages, the least you can do is maintain a portfolio that is uncorrelated with your labor income. As the Enron case has taught us, too many are unaware of the perils of having their pension income tied to their career, employment, and compensation. Investing a significant fraction of your portfolio in the industry you work in is akin to a "Texas hedge," betting on the horse you own.

12. Insurance companies offer life insurance on your children. Is this a good idea?

20.10 MATRIMONY, BEQUEST, AND INTERGENERATIONAL TRANSFERS

In the context of a retirement plan we think of risk in terms of safety first, where mean-variance analysis is inadequate. We have already touched on this issue earlier, in the context of (1) raising the ROR with risky investments, (2) avoiding savings plans that rely too heavily on savings in later years, and (3) acquiring life insurance and including life annuities in the savings portfolio.

One sort of insurance the market cannot supply is wage insurance. If we could obtain wage insurance, a savings plan would be a lot easier to formulate. **Moral hazard** is the reason for this void in the marketplace. Moral hazard is the phenomenon whereby a party to a contract (deal) has an incentive to change behavior in a way that makes the deal less attractive to the

moral hazard

The phenomenon whereby a party to a contract has an incentive to change behavior in a way that makes the contract less attractive to the other party.

[12]For this reason, life insurance policies include fine print excluding payment in case of events such as wars, epidemics, and famine.

other party.[13] For example, a person who buys wage insurance would then have an incentive to consume leisure at the expense of work effort. Moral hazard is also why insuring items for more than their market or intrinsic value is prohibited. If your warehouse were insured for lots more than its value, you might have less incentive to prevent fires, an obvious moral hazard.

In contrast, marriage provides a form of co-insurance that extends also to the issue of longevity. A married couple has a greater probability that at least one will survive to an older age, giving greater incentive to save for a longer life. Put differently, saving for a longer life has a smaller probability of going to waste. A study by Kotlikoff and Spivack (1981)[14] simulated reasonable individual preferences to show that a marriage contract increases the dollar value of lifetime savings by as much as 25%. Old sages who have been preaching the virtue of matrimony for millennia must have known more about economics than we give them credit for.

Bequest is another motive for saving. There is something special about bequest that differentiates it from other "expense" items. When you save for members of the next generation (and beyond), you double the planning horizon, and by considering later generations as well, you can make it effectively infinite. This has implications for the composition of the savings portfolio. For example, the conventional wisdom that as you grow older you should gradually shift out of stocks and into bonds is not as true when bequest is an important factor in the savings plan.

Having discussed marriage co-insurance and bequest, we cannot fail to mention that despite the virtues of saving for the longest term, many individuals overshoot the mark. When a person saves for old age and passes on before taking full advantage of the nest egg, the estate is called an "involuntary, intergenerational transfer." Data shows that such transfers are widespread. Kotlikoff and Summers (1981)[15] estimate that about 75% of wealth left behind is actually involuntary transfer. This suggests that people make too little use of the market for life annuities. Hopefully you will not be one of them, both because you will live to a healthy old age and because you'll have a ball spending your never-expiring annuity.

13. If matrimony is such a good deal, but you haven't yet found a soul mate, should you rush to surf the Web for a potential spouse?

SUMMARY

- The major objective of a savings plan is to provide for adequate retirement income.
- Even moderate inflation will affect the purchasing power of the retirement annuity. Therefore, the plan must be cast in terms of real consumption and retirement income.
- From a standpoint of smoothing consumption it is advantageous to save a fixed or rising fraction of real income. However, postponement of savings to later years increases the risk of the retirement fund.
- The IRA-style tax shelter, akin to a consumption tax, defers taxes on both contributions and earnings on savings.
- The progressive tax code sharpens the importance of taxes during the retirement years. High tax rates during retirement reduce the effectiveness of the tax shelter.
- A Roth IRA tax shelter does not shield contributions but eliminates taxes during retirement. Savers who anticipate high retirement income (and taxes) must examine whether this shelter is more beneficial than a traditional IRA account.

[13]Moral hazard and adverse selection can reinforce each other. Restaurants that offer an all-you-can-eat meal attract big eaters (adverse selection) and induce "normal" eaters to overeat (moral hazard).

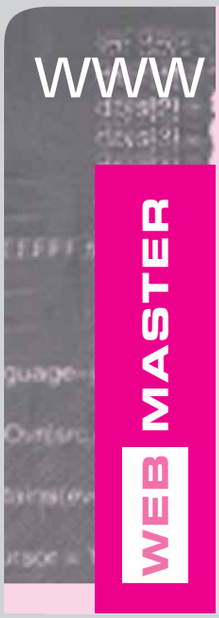
[14]Laurence J. Kotlikoff and Avia Spivack, "The Family as an Incomplete Annuities Market," *Journal of Political Economy* 89, no. 2 (April 1981), pp. 372–91.

[15]Laurence J. Kotlikoff and Lawrence H. Summers, "The Role of Intergenerational Transfers in Aggregate Capital Accumulation," *The Journal of Political Economy* 89, no. 4 (August, 1981), pp. 706–32.

- 401k plans are similar to traditional IRAs and allow matched contributions by employers. This benefit should not be forgone.
- Capital gains can be postponed and later taxed at a lower rate. Therefore, investment in low-dividend stocks is a natural tax shelter. Investments in interest-bearing securities should be sheltered first.
- Social Security benefits are an important component of retirement income.
- Savings plans should be augmented for large expenditures such as children's education.
- Home ownership should be viewed as a hedge against rental cost.
- Uncertain longevity and other contingencies should be handled via life annuities and appropriate insurance coverage.

KEY TERMS

401k plans, 000
adverse selection, 000
flat tax, 000
life annuity, 000
longevity, 000
moral hazard, 000
progressive tax, 000
real consumption, 000
retirement annuity, 000
Roth IRA, 000
Social Security, 000
tax shelters, 000
traditional IRA, 000



Retirement Calculator

As discussed in the text, one of the major determinants of investment performance is asset allocation. A retirement calculator that allows you to specify different allocations and different levels of desired income to test the ability to meet your retirement goals is available at **www3.troweprice.com/ric/RIC**.

1. What level of retirement assets will you need to support a retirement income level of $7,000 per month with 90% certainty? Assume that you will retire when you are 60 and that you expect to live for 30 years after you retire and that your portfolio allocation is 60% stock, 30% bonds, and 10% cash. Work in increments of $100,000 in retirement assets.
2. How much would you need to have in retirement assets to meet the same goal with a 99% certainty?
3. If you return to the original 90% certainty level, how much would you need in retirement assets to meet your original goal with a 40% stock, 40% bond, and 20% cash allocation?

PROBLEM SETS

1. With no taxes or inflation (Spreadsheet 20.1), what would be your retirement annuity if you increase the savings rate by 1%?
2. With a 3% inflation (Spreadsheet 20.2), by how much would your retirement annuity grow if you increase the savings rate by 1%? Is the benefit greater in the face of inflation?
3. What savings rate from real income (Spreadsheet 20.3) will produce the same retirement annuity as a 15% savings rate from nominal income?
4. Under the flat tax (Spreadsheet 20.4), will a 1% increase in ROR offset a 1% increase in the tax rate?
5. With an IRA tax shelter (Spreadsheet 20.5), compare the effect on real consumption during retirement of a 1% increase in the rate of inflation to a 1% increase in the tax rate.
6. With a progressive tax (Spreadsheet 20.6), compare an increase of 1% in the lower tax bracket to an increase of 1% in the highest tax bracket.

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7. Verify that the IRA tax shelter with a progressive tax (Spreadsheet 20.7) acts as a hedge. Compare the effect of a decline of 2% in the ROR to an increase of 2% in ROR.
8. What is the trade-off between ROR and the rate of inflation with a Roth IRA under a progressive tax (Spreadsheet 20.8)?
9. Suppose you could defer capital gains tax to the last year of your retirement (Spreadsheet 20.9). Would it be worthwhile given the progressivity of the tax code?
10. Project your Social Security benefits with the parameters of Section 20.6.
11. Using Spreadsheet 20.10, assess the present value of a 1% increase in college tuition as a fraction of the present value of labor income.
12. Give another example of adverse selection.
13. In addition to expected longevity, what traits might affect an individual's demand for a life annuity?
14. Give another example of a moral hazard problem.

SOLUTIONS TO CONCEPT checks

1. When ROR falls by 1% to 5%, the retirement annuity falls from $192,244 to $149,855 (i.e., by 22.45%). To restore this annuity, the savings rate must rise by 4.24 percentage points to 19.24%. With this savings rate, the entire loss of 1% in ROR falls on consumption during the earning years.
2. Intuition suggests you need to keep the real rate (2.91%) constant, that is, increase the nominal rate to 7.03 (confirm this). However, this will not be sufficient because the nominal income growth of 7% has a lower real growth when inflation is higher. Result: You must increase the real ROR to compensate for a lower growth in real income, ending with a nominal rate of 7.67%.
3. There are two components to the risk of relying on future labor income: disability/death and career failure/unemployment. You can insure the first component, but not the second.
4. Holding before-tax income constant, your after-tax income will remain unchanged if your average tax rate, and hence total tax liability, is unchanged:

$$\text{Total tax} = (\text{Income} - \text{Exemption}) \times \text{Tax rate, or } T = (I - E) \times t$$

   A 1% increase in the tax rate will increase T by $.01(I - E)$. A 1% increase in the exemption will decrease T by $.01 \times E \times t$. Realistically, $I - E$ will be greater than $E \times t$ and hence you will be worse off with the increase in exemption and tax rate.
5. The qualitative result is the same. However, with no shelter you are worse off early and hence lose also the earning power of the additional tax bills.
6. No, an increase in the low-bracket tax rate applies to your entire taxable income, while an increase in the high-bracket tax rate applies only to a fraction of your taxable income.
7. No, in your hypothetical case, the Roth IRA tax shelter produces less taxes yet a smaller real retirement annuity. The reason is the timing of the taxes. The timing issue does not affect the stream of tax revenues to the IRS because at any point in time, taxpayers are distributed over all ages. In this case, the IRS can replace all Roth IRAs with traditional IRAs and lower the tax rates. The IRS will collect similar revenue each year, and retirees will enjoy higher real retirement annuities.
8. No, in terms of cash income, preferred stocks are more similar to bonds.
9. Your projected retirement fund is risky because of uncertainty about future labor income and future real returns on savings. The projected Social Security real annuity is risky because of political uncertainty about future benefits. It's hard to judge which risk is greater.
10. You can invest in savings accounts that yield a floating rate tied to an index of college tuition.
11. A fixed-rate mortgage is the lower risk, higher expected cost option. Homeowners with greater risk tolerance might opt for a variable-rate mortgage which is expected to average a lower rate over the life of the mortgage.
12. In the old days, children were more than a bundle of joy; they also provided a hedge for old-age income. Under such circumstance, insuring children would make economic sense. These days, children may well be a financial net expenditure, ruling out insurance on economic grounds. Other nonfinancial considerations are a matter of individual preference.
13. Rushing into marriage for economic reasons is a very risky proposition. A bad marriage can be a financial, as well as an emotional, calamity.