PRE- AND POST-RETIREMENT ASSET ALLOCATION: A SIMULATION OF RETIREMENT INVESTMENT STRATEGIES FOR AGRICULTURAL PRODUCERS

by

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(ABSTRACT)

This research simulates pre-retirement investment scenarios for agricultural producers. Thirty-two investment scenarios are examined, with each scenario differing with respect to retirement vehicle, investment strategy of the producer, and the use of a cash margin for reinvestment in the operation versus prepaying term debt (cash preference). The retirement vehicles included in this study are Individual Retirement Accounts (IRAs), Simplified Employee Pension Plans (SEPs), and 401(k) plans. Investment strategies reflect the producer's preference for investing in conservative, balanced, or aggressive assets, or a combination of these assets. Further, these scenarios are examined for three methods of capitalization: Case I - an operation with a 50 percent debt/asset ratio; Case II - an operation with a 65 percent debt/asset ratio; Case III - an operation with a 65 percent debt/asset ratio with a majority of the farm land being leased.

The analytical model simulates the annual cash flows of a commercial agricultural operation for each investment scenario over a 30-year period. Stochastic rates of return, generated using a vector-autoregressive (VAR) model, are incorporated

into the simulation model. Each scenario is replicated 100 times using different vectors of stochastic rates of return.

Results show investment in retirement vehicles does not significant reduce ending farm assets, regardless of investment strategy or cash preference of the producer. Use of retirement vehicles does have a significant positive impact on ending net worth for the producer. IRAs are not significant investment tools for producers (or spouses) who are participants in another qualified retirement plan.

Investment strategy has a major impact on ending net worth. Aggressive and dynamic (aggressive to conservative as retirement approaches) investment strategies dominate conservative and balanced strategies. Use of cash margin to prepay debt has no advantage over reinvesting in the farm.

Retirement vehicles greatly improve the probability of meeting estimated family living needs during retirement, and generate greater diversity and liquidity of the retirement portfolio. Further, retirement vehicles are more important for producer with highly-leveraged operations and for producers who lease a majority of their assets.

DEDICATION

To Mean Jean and Jimbo, for all their support (and teasing).

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Chapter 1

Introduction

"No area of financial planning is given greater lip-service, perhaps, than that of retirement planning." Roger Smedley

American families tend to neglect planning for retirement. According to Tyson more than one-half of Americans between the age of 18 and 34 have not begun to save for retirement, while more than one-fourth of Americans between the age of 35 and 54 have not started saving for retirement. It is estimated that one-third of the population over age 65 have no income from savings, while the median income for people over the age of 65 is $10,200 (Associated Press). Joel Williams, Certified Financial Planner for Dean Witter-Reynolds in Blacksburg, Virginia, provides the following breakdown on adults' preparation for retirement:

- 1 percent of adults will retire wealthy
- 4 percent will retire financially secure
- 20 percent must continue to work during the retirement years to meet living expenses
- 49 percent must rely on Social Security to meet basic living expenses
- 26 percent will not live to retirement age

In 1988 only 46 percent of the U.S. work force was covered by private or government pension plans (Gendell and Siegel). Leech estimates that Social Security was the major source of income for 62 percent of retirees in 1984, and Social Security provided 90 percent or more of income for 15 percent of retirees. USA Today reports only one-third of U.S. adults participate in 401(k) retirement plans. Avery and Kennickell estimate that only 27.3 percent of U.S. adults have Individual Retirement Accounts (IRAs) or Keogh Pension Plans.

Table 1.1 shows the average annual expenditure per household on retirement/pension accounts and Social Security based on 1990 Bureau of Labor Statistics data (American Demographics). It also indicates the average annual expenditures on retirement investments for single female and single male consumers based on 1984-85 Bureau of Labor Statistics Consumer Expenditure Survey (Shipp). This table indicates the largest market for household financial retirement products and services is consumers between the ages of 45 and 54. This segment of the population devotes over 11 percent of their total household expenditures to retirement investments. However, this study suggests 55- to 64-year olds outspend all other age groups on IRAs, Keoghs, and accountant fees. Table 1.1 also indicates that single males typically invest more per year in retirement vehicles than single females. For both sexes, the maximum average annual investment occurred in the 35-44 age group.

People instinctively know they should be planning for retirement, but relatively few people have the financial discipline, stamina, and skills to accomplish it well (Smedley). Smedley state the number one failure in retirement planning is the failure to begin saving and investing early enough.

Along with the lack of retirement planning, the U.S has a low average savings rate. From a national standpoint, the U.S. saved approximately 3.6 percent of the gross domestic product (GDP) in the 1980s. This is relatively low when compared to a national savings rate of 8.4 percent in Canada, 10.2 percent in Germany, and 17.8 percent in Japan (Garner). At the household level, the U.S. Department of Commerce estimates the U.S. savings rate to be 4.5 percent of disposable personal income (Courtless). This rate has fallen from 6.0 percent since 1980. Scott indicates people typically do not begin saving for retirement until they are within ten years of retirement. The lack of retirement planning and the lower savings rate are major concerns for the future of American retirees.

In the agricultural sector, retirement planning for most families traditionally concentrates on the inter-generational transfer of assets, with very little emphasis on

Table 1.1 Average Annual Household Expenditure on Retirement Accounts and Social Security - 1990

Age Group	Average Annual Expenditure per Household on Retirement, Pensions, & Social Security
Under age 25	$926
25-34	$2,052
35-44	$2,756
45-54	$2,991
55-64	$2,191
65-74	$682
75+	$119

Average Annual Expenditures for Single-Female Consumer Units - 1984-85

	Personal Insurance & Pension	Retirement, Pension, & Social Security
Under age 25	$352	$334
25-34	$1,476	$1,397
35-44	$1,841	$1,729
45-54	$1,258	$1,156
55-64	$1,342	$907
65+	$115	$54

Average Annual Expenditures for Single-Male Consumer Units - 1984-85

	Personal Insurance & Pension	Retirement, Pension, & Social Security
Under age 25	$470	$446
25-34	$1,531	$1,414
35-44	$2,255	$2,068
45-54	$2,009	$1,829
55-64	$1,597	$1,441
65+	$228	$134

Sources: 1990 Bureau of Labor Statistics; 1984-85 Bureau of Labor Statistics Consumer Expenditure Survey planning for the family's financial security during the retirement years. A typical retirement plan for many farm families is to reinvest excess funds into the farming operation. Thus, the retirement account for a farm family typically is comprised of physical assets (real estate, machinery, livestock, etc.) rather than financial assets (Individual Retirement Accounts, Keogh or Simplified Employee Pensions Plans, insurance policies, passbook savings, etc.). On average, 70 percent of a producer's total assets is comprised of real estate, and another 20 percent is invested in machinery and livestock (USDA). A major drawback of such a portfolio is the family usually must either partially or totally liquidate these physical assets in order to acquire the funds necessary for meeting family living needs and health care costs during retirement.

Reinvestment in the farm business may be a feasible retirement strategy for many farm families. However, a farm family should consider several issues related to retirement. These issues include:

- profitability, wealth accumulation, liquidity, and risk (inflation risk and risk of losing capital) associated with farm and nonfarm investments,
- family/business goals and needs during the retirement years,
- tax implications of investing in farm and nonfarm assets,
- future of the farming operation upon retirement of the farm family (sell the farm or transfer management to next generation), and
- anticipated life span after retirement.

Clearly, retirement planning for farm families is not a simple issue. A comprehensive retirement plan requires consideration of the risk, profitability, tax (pre- and post-retirement), and asset transfer implications associated with their decisions.

Aside from planning for retirement, the farm family should also consider its financial strategy during the retirement years. The family should estimate the level of annual income they will need to meet their desired standard of living during retirement. Current retirement literature suggests families will need 60 to 80 percent of their pre-retirement annual income for living expenses during retirement. However, Rogers suggests that farm families may require more than 100 percent of their pre-retirement annual income during retirement (Taylor). This is due to the loss of several tax-deductible business expenses related to the farming operation. Examples of expenses which may be sheltered under the farm operation include insurance, property taxes, fuel, and utilities.

Farm families have five general sources of annual income during retirement: 1) personal retirement portfolio, 2) rental income and/or proceeds from continued operation of the farm by relatives or partners, 3) Social Security benefits, 4) company pension plans for those with off-farm jobs or nonfarm businesses, and 5) continued employment during the retirement years. MoneyTree estimates the composition of income for the average American retiree over the age of 65 to be:

36 percent from Social Security
24 percent from investment assets
18 percent from pensions
18 percent from post-retirement earnings
4 percent from other sources

The family should consider the implications of using any of the above sources of retirement income. Key considerations include:

- How should the family liquidate (annuitize) its personal retirement portfolio?
- How much income will be provided by sale, lease, or continued operation of the farm?
- What fringe benefits will be provided by continued operation of the farming operation?
- What funds will be provided by Social Security and the off-farm job pension plans?
- What death benefits are provided by each type of retirement account?

The producer and spouse must also estimate their life span after they retire. This is helpful in determining how long their retirement portfolio must last. Monthly Labor Review reports people are currently living approximately 15 to 19 years after they retire.

Problem Statement

An agricultural producer has five main options for utilizing excess funds (margin) from the farming operation. First, the producer may use this margin for increased consumption by the family, in the form of vacations or the purchase of consumer goods. Second, the margin may be kept in relatively liquid accounts so as to build internal liquidity, either for the business or the family. Third, the margin may be used to pay down existing debt. The fourth use of excess funds is to reinvest in the farm business, in the form of real estate, machinery, or livestock. The fifth main use of excess funds is to invest in nonfarm investment vehicles. Examples of off-farm investments include mutual funds, stocks, bonds, and qualified retirement plans such as IRAs, Keoghs, or Simplified Employee Pension (SEP) plans.

Marker indicates the main retirement investment strategy for agricultural producers is to re-invest excess funds from operations into the farm. Popular uses of excess funds include purchasing real estate, livestock, machinery, or other physical assets. This retirement investment strategy may entail problems with risk, liquidity, and wealth accumulation, as well as the relatively large tax liabilities related to the liquidation of the farm assets.

This strategy may be risky because the resulting portfolio (farm assets) is typically not well diversified. If the farm meets some form of adversity (drought, flood, poor market conditions, etc.), the entire portfolio may be lost. However, a diversified retirement portfolio should contain assets not positively correlated to the farm assets. In this situation the entire portfolio may not be lost if the farm meets with adversity.

The liquidity problem associated with reinvestment into the farm lies in the fact that farm assets are not as liquid as most financial assets. It typically takes time, effort, and added costs (sales commissions, transfer fees, etc.) to liquidate farm assets. Further, proceeds from the liquidation of farm assets are subject to deferred taxes, which can amount to 30 to 40 percent of the value of the assets (Kohl).

As for wealth accumulation, reinvestment into the farm may be very profitable over time. Studies show the average return to land has been 10.8 percent since 1946 (Irwin, et al.). This is a favorable return when compared to the rates of return on certificates of deposit, savings accounts and bonds over the same time period. Historically, the stock market has averaged a return of between 12 and 15 percent, as measured by Ibbottson. However, when one considers the risk involved with investments in farm assets due to weather, market cycles, structural change, and government regulation, the producer must determine whether the relative profitability of the farm assets is worth the added risk.

In recent years the U.S. government has shifted the responsibility for retirement planning to the individual. This has been accomplished by encouraging the development of several company-sponsored and individual-sponsored retirement vehicles to supplement the Social Security benefits retirees may receive. Producers should realize the benefits they receive from Social Security typically are not enough to cover basic living expenses. Individuals should not view Social Security as the only retirement plan they will need to support themselves during retirement.

There are several nonfarm retirement investment vehicles available for use by farm families. These include Individual Retirement Accounts (IRAs), Keogh Plans, Simplified Employee Pension Plans (SEPs), and cash-value insurance policies. Also, families with at least one spouse working off the farm may be eligible for enrollment in corporate pension plans and/or 401(k) or 403(b) retirement plans through the nonfarm business. These nonfarm investments may prove to be powerful retirement tools for farmers. Retirement investment vehicles may provide increased liquidity and wealth accumulation upon age of retirement by investing in assets with greater returns than the farming operation. They may also reduce investment yield risk through diversification, rather than having the entire retirement portfolio invested in the farm business (Mantey). Further, such risk reduction measures are looked upon favorably by the lending industry.

Nonfarm retirement investment vehicles may also prove to be significant tax management tools for the farm family. For example, assume a farm operator invests $2,000 per year in an IRA. This $2,000 is tax-deductible, thereby reducing the annual tax liability for the operator. Further, investments in IRAs and the resulting growth of the IRA due to increase in asset value are tax-deferred. These funds are not taxed until the funds are removed from the IRA. Thus, nonfarm retirement investments may provide increased wealth accumulation at retirement through the compounding of tax-deferred dollars.

Further, much confusion surrounds the issue of how to manage the retirement portfolio during the retirement years. Strategies depend on family and business goals, life expectancies for each spouse, tax laws (current and expected tax laws), the standard of living desired during retirement, and the overall economy. Careless management of the retirement portfolio may place retirees in serious financial straits.

Research Objectives

Anecdotal evidence and a review of literature reveals that little research has been conducted in the area of retirement alternatives available for agricultural producers. This study has two main objectives. The first objective is to investigate various pre-retirement investment strategies for farm families. Specifically, this study will analyze the wealth accumulation, risk, and tax implications associated with several pre-retirement investment strategies applicable to farm families. This objective will also allow analysis of the liquidity generated during the retirement years as a result of the various pre-retirement investment strategies.

The second objective of this study is to determine the implications of increases in the marginal tax rate on retirement investing. This objective is intended to assist farm families in determining whether it is more profitable to pay their income taxes first and invest any excess funds, or to use tax-advantaged retirement investment vehicles.

Methodology

A spreadsheet model is developed to simulate the impacts of selected investment strategies for farm families. This model assumes a starting financial position for a given farm family scenario. Annual cash flows (farm and nonfarm) for each investment strategy are simulated over a 30-year period. These annual cash flows are used to generate the annual cash margin available for investment in farm and/or nonfarm investments. Each investment strategy is replicated 100 times, using different vectors of stochastic rates of return and interest rates for each replication. Output from these simulations allows analysis of the wealth accumulation, liquidity, risk, and tax liability associated with each investment strategy.

This study assumes the marginal tax rate remains at current levels throughout the 30-year planning horizon. To assess the impact of a change in the marginal tax rate at time of retirement, a breakeven tax rate is estimated. The breakeven tax rate is the average (not marginal) income tax rate at the time of retirement at which investment in tax-deferred retirement vehicles over the planning horizon is equal to investment in taxable assets.

Organization of Dissertation

The remainder of this dissertation is organized as follows. Chapter 2 is a review of previous research in the area of retirement planning. This chapter also includes a brief discussion of the nonfarm retirement investments available to farm families. Chapter 3 will outline the simulation models and the sources of data used in the simulation model. Chapter 4 contains the results of the analytical models and associated analyses. Chapter 5 presents the results and conclusions obtained through this research, as well as recommendations for additional research in the area of retirement planning and investing.

Chapter 2

Literature Review

"95 percent of Americans must depend on their children,
Social Security, and other sources for retirement income."
Thomas Nolan

Chapter 2 begins with a discussion of previous research in the area of retirement planning and investing. Following this discussion is a summary of the main retirement investment vehicles available to individuals.

Previous Research

A review of literature shows little previous research in the area of retirement investments for agricultural producers. Several articles have been published on the valuation of farm assets and farm real estate (Irwin, Forster, Sherrick; Bjornson and Innes; Crisostomo and Featherstone), but relatively few articles have been published on the subject of retirement investments. Tauer discussed the methods of calculating values of alternative retirement investments. His research is based on the time value of money concept. He estimates the future value of ten-year annuities under varying investment situations. He investigated tax-deferred investments (Keogh plans and IRAs), farm investments, and other investments (savings accounts or stock purchase plans).

Tauer's results indicate that the use of tax-deferred investments, such as Keoghs and IRAs, generally produce greater portfolio value at retirement than non-tax-deferred investments. The advantage of tax-deferred investments becomes greater with higher rates of return and with lower marginal tax rates at the age of retirement. Tauer does indicate that an increase of 10 percentage points in the marginal tax rate at retirement gives the advantage to non-tax-deferred investments. While tax-deferred investments generally have an advantage over farm investments, farm investments tend to outperform non-tax-deferred nonfarm investments, such as savings accounts. This is due to tax advantages accorded to the farm investments. However, his analyses include investment tax credits and capital gains taxes that no longer apply. Tauer mentions that producers should not base their decisions solely on expected financial return of retirement investments. They should also consider the liquidity and risk of the investments.

While Tauer's study is useful in determining the value of investment portfolios at retirement, it has a few shortcomings. First, Tauer's study assumes an arbitrary constant contribution (annuity) to the portfolio in each year. While the use of annuities provides a general method of estimating future values, it may not be realistic. Producers may not be able to make constant payments every year. Further, the amount of the annual tax-deductible contribution depends on factors such as level of income and participation in other qualified retirement plans. Tauer also assumed constant annual rates of return in this study. Again, this is a general method of estimation, but it is not especially realistic. Rates of return on farm and nonfarm investments tend to exhibit trends and cycles over time. Therefore, a more realistic approach is to simulate these trends and cycles over time for rates of return. By ignoring variability in contributions and rates of return, Tauer excludes risk from his study. A further problem with Tauer's study is that it does not address the tax implications of investing in nonfarm retirement plans. It does handle tax-deferment, investment tax credits (which no longer exist) and capital gains taxes, but it does not mention the tax savings enabled by the tax-deductibility of contributions to retirement plans. Thus, there is a short-term tax management strategy associated with retirement investments which is overlooked.

Spence and Mapp developed a simulation model to evaluate investment opportunities available to retiring farmers who have not established a nonfarm retirement portfolio. The authors state that any study to analyze retirement investments must consider the expected value of return from the portfolio relative to the needs of the retiree, the variability of real return for the portfolio, and the allocation of real returns and economic needs over the retiree's planning horizon.

Spence and Mapp's simulation model determined the outcomes of several investment and estate planning strategies. It allows the user to compare the simulated results of different strategies rather than determining the optimal strategy. This model projects the performance of the farm and nonfarm investments over a user-specified planning period, typically determined by the life expectancy of the individual or couple. The performance of the investment portfolio is then matched against the simulated income needs for the couple for each year of the planning horizon. The model then determines the amount of funds that can be withdrawn from the portfolio each year. These withdrawals may be just the earnings of the portfolio to funds obtained through liquidation of a portion of the portfolio's capital base. The model is also capable of determining the size of the estate that will be passed on to the next generation.

The authors incorporated variability of income and returns in their simulation model. The simulator generates a random series of annual returns for each asset type, using the expected average rate of return supplied by the user, a variance/covariance matrix of returns derived from historical data, and the assumption that annual rates of return are normally distributed around average rates of return. The authors state their simulated annual returns are normally distributed about the mean and are "appropriately correlated" with the rates of return on other assets which are generated in each year. As each set of simulated returns represents one of an infinite number of outcomes, the simulation is replicated fifteen times. This allows the user to analyze the expected outcomes (return) and the variability (risk) of the outcomes associated with each retirement strategy.

The authors present two retirement investment strategies for discussion. The first strategy involves selling the farm real estate and investing the proceeds in income stocks and long-term bonds. The second scenario involves keeping the farm assets and investing surplus income in growth mutual funds . The second strategy proved to be significantly more successful in meeting retirement income needs. It also tended to generate a larger ending estate than the first strategy.

Spence and Mapp's study is quite practical, however the results may not be relevant in today's environment. The variance/covariance matrix was generated from historical data from 1959 to 1972. This period tended to be one of lower variability in farm returns than recent years. Additionally, several retirement plans for self-employed individuals (Keoghs, SEPs, and IRAs) were not available for producers during this time period. Also, this analysis included capital gains taxes, which are no longer available for producers. Further, Spence and Mapp's research only considers investment strategies during the retirement years. It does not consider pre-retirement investment strategies as does this dissertation.

Monke, et al., investigated the impacts of different tax policies and risk preferences on agricultural producer's investment portfolios. The authors identified nine investment assets for their analysis: Farm assets, farm land to be cash-rented to another producer, long-term US government bonds, high-grade municipal bonds of state and local governments, AA-grade corporate bonds, common stocks, US treasury bills, six-month certificates of deposit (CDs) and six-month-maturity commercial paper. Statistical comparison of these investment assets shows the mean total rate of return for farm assets (10.7 percent) is comparable to the mean total return for stocks (10.4 percent) and farmland (10.6 percent). A difference between these assets is the composition of the returns. Farm assets tend to have greater current returns and lower capital gains than stocks. Further, the authors state that the rates of return on farmland

and farm assets tend to be highly-positively correlated; however, they tend to be negatively correlated to rates of return for stocks and bonds. Also, the correlation between the annual rates of return for farm assets and the rate of inflation is positive. Thus, investment in farm assets tends to protect the investor from reduced purchasing power during inflationary times.

Monke, et al., developed a simulation model to calculate the after-tax future value of specific investment strategies under five income tax policies. The simulation model is for a planning horizon of ten years. The model assumes an arbitrary before-tax investment of $1,000, indexed for five percent inflation for the remaining years. This annual contribution is distributed between various investment assets in a constant proportion over the entire planning horizon. The rates of return (current and capital gains) for each asset are generated through a multivariate random-distribution generator. The returns are correlated as determined from the distribution of historic rates of return between 1960 and 1988. All ending portfolios are liquidated as a lump sum.

Distributions are generated for each of 39 different investment strategies through 150 replications of the simulation model. A majority of the strategies include some form of tax-deferred investment under the rules for IRAs and Keogh plans. Each strategy is then evaluated under five tax policies. The tax policies differ mainly in their treatment of capital gains taxes. Stochastic dominance analysis is used to identify the efficient set of investment strategies for eight different levels of risk preference.

The results indicate that greater after-tax mean future values may be achieved through diversification of the portfolio, while exposing the investor to the same (or less) risk as for single-asset portfolios. Further, the results indicate the importance of tax-deferred investments such as IRAs and Keogh plans. Specifically, if the investor expects his/her marginal tax rate to decrease in retirement, the tax-deferred investments become more strongly preferred over investment in farm assets.

A drawback of this research is that it does not specifically handle the aspect of retirement. The planning horizon is ten years, which does not necessarily correspond to a specific phase of the producer's life. That is, the ten-year period may be relevant for a beginning producer, a middle-aged producer or for a producer who is ready to or has already retired. Producers in each phase of their life face different goals, needs, and therefore, decisions. Another drawback is the assumption of an initial before-tax contribution of $1,000 (indexed for inflation). This contribution does not take full advantage of the tax-deductible contributions allowed by IRAs, Keogh plans, and SEPs. By assuming the deferment of taxes on small amounts of income rather than the maximum amount allowable by law, the results of this simulation might be biased towards non-tax-deferred investment assets. Further, this study assumes constant risk-preferences over the entire planning horizon. Anecdotal evidence and popular press articles suggest that investors become more conservative (less risk-preferring) as they grow older. Therefore, producers exhibit different degrees of risk-preference over time.

Burns and Widdows examined the expected retirement gap for baby boomers (people born between 1945 and 1964). The retirement gap is defined as the consumption needs during retirement minus the assets available at retirement. The authors define assets at retirement to include Social Security benefits, pension benefits, home equity, and other savings. Retirement consumption needs are based on a percentage of pre-retirement income. The authors base the consumption needs on 75 percent of pre-retirement income. The results of this study indicate that baby boomers currently face a positive retirement gap (needs are greater than available assets). In order to overcome this retirement gap baby boomers must either increase their retirement savings or lower their retirement consumption expectations to meet income needs.

Hogarth studied the patterns of savings and dissavings during retirement. This research identified five main patterns of saving and dissaving during the retirement years. The most prevalent pattern (43.5 percent of the sample) is "some savings, some level periods". In this pattern, retirees alternate between periods of increased savings and periods of constant savings. The next most prevalent pattern (26.9 percent) is the "local maximum". This pattern shows increased levels of savings up to a certain age, at which point savings steadily decrease. The "local minimum" pattern is observed for 17 percent of the sample. This pattern shows a decreased level of savings (increased dissavings) until a certain age in retirement, at which point the level of savings begins to steadily increase. The fourth pattern is "alternating savings and dissavings". Here, the level of savings increases and decreases in a cyclical manner. This pattern is observed for 8.5 percent of the sample. The last pattern (4.2 percent) is "some dissaving, some level periods". This pattern is the opposite of the most prevalent pattern. Here, the retiree alternates between periods of decreasing savings and periods of level savings.

Lee and Hanna re-examine Hogarth's patterns of savings/dissavings using a simulation model based on Ando and Modigliani's simple life cycle savings theory. This theory implies that consumers tend to dissave after retiring. Lee and Hanna's study confirms that it is possible to derive saving and dissaving patterns similar to the patterns identified by Hogarth, based on the simple life cycle savings theory. Conclusions from this study are that consumers must carefully manage their retirement portfolios after retirement in order to supplement pension income and to provide for emergencies not covered by insurance. The authors state that post-retirement savings patterns are dependent on the household's tastes, demographic characteristics, and financial situation. Further, the authors contend that older people continue to save during retirement due to uncertainties about their health, length of life, and financial security. Stoller also concludes the uncertainty about the length of one's life is a rational reason for saving during retirement. Mirer found that most retirees do not dissave their wealth as fast as the simple life cycle saving theory suggests.

When the time comes to withdraw funds from the retirement portfolio, one faces the problem of how to withdraw the funds. There are three basic options: lump-sum distributions, annuitized distributions, and rollovers. Each option has different tax implications, as distributions from retirement plans typically tax the distributions as ordinary income in the year they are received. For a lump-sum distribution, the entire amount of the retirement portfolio is taxed in one year. This will typically move the producer into a higher marginal tax bracket in that year; however, the remaining after-tax amount is no longer subject to taxation, and these funds are readily available for use by the taxpayer. For an annuity, the annual distribution is generally taxed as ordinary income in the year in which the distribution is made. This may allow the taxpayer to remain in the same marginal tax bracket, thus reducing the producer's tax liability. However, the remaining funds are not as readily available as with the lump-sum distribution. A rollover is simply a method of deferring taxes on distributions from other retirement plans. These distributions are re-invested into another qualified investment, typically an IRA. No taxes are paid on these distributions until the funds are withdrawn from the rollover account.

Wilcox states the smartest move may be to take retirement fund distributions as a lump sum, and use rollover accounts to reduce the current tax liability. If a plan does not allow lump-sum distributions, one must decide which form of annuity to choose. Wilcox states that retirement plan beneficiaries usually have from two to ten choices of annuity payments. These annuity choices include single-life, joint and survivor, life annuity with 10- or 20-years certain payments, level-income, and refund annuities. Single-life annuities pay benefits until one's death. There are no benefits for the surviving spouse. Joint and survivor annuities guarantee the spouse will receive one-half of the benefit payment after one's death. This guarantee comes at the cost of reduced monthly payments, usually ten to twenty percent lower than for single-life annuities. Joint and survivor annuities may provide for greater benefits for the spouse after one's death, at the cost of further reduced monthly benefits. Life annuities with 10- or 20-years certain payments are basically the same as single-life annuities. However, this form allows one's beneficiary to receive benefit payments should he/she die before receiving either 10 or 20 years of payments. This form of annuity will reduce the monthly benefit by about 7 percent for 10-years certain, and 18 percent for 20-years certain payments. A refund annuity stipulates that the surviving spouse receive a lump-sum distribution equal to the difference between the original lump-sum amount of the benefits and the payments already received. This cost of this form is 5 to 10 percent lower monthly benefits than for a single-life annuity. A level-income annuity is an option for those who retire before the normal retirement age (currently 65 years of age). This type pays larger monthly benefits until the retiree starts to receive Social Security benefits. At that time the retiree receives smaller monthly benefits. Wilcox recommends one consider your health, your spouse's health, and whether your pension will be the major source of income for your spouse after your death when considering which of these forms of annuities is best for your situation.

Risk Attitudes of Agricultural Producers

Agricultural producers face several forms of risk. From an investment standpoint, producers face diversifiable (nonsystematic) and market (systematic) risk (Brigham and Gapenski). Diversifiable risks are inherent to the firm. Company-specific events which impact the net returns of the firm, such as lawsuits, labor problems, or localized weather or pest problems, are examples of diversifiable risk. Risk associated with these events may be reduced, or eliminated, through diversification. The producer may reduce these risks by diversifying his/her enterprise mix, or by diversifying his/her investment portfolio (farm and nonfarm investments).

Market risk reflects adverse changes in the value of an asset due to factors external to the firm. These factors, including war, inflation or recession, and international politics, affect the entire marketplace; thus, market risk cannot be reduced or eliminated through diversification. Market risk may be reduced through use of risk management tools such as crop or peril insurance.

Investment in an asset can have two main adverse outcomes: loss of principal and loss of purchasing power. The investment can result in a loss of principal through a decrease in the value of the asset. The capital loss caused by a decrease in the market price of a stock is an example of the loss of principal. Loss of purchasing power results when an investment fails to generate a rate of return greater than the rate of inflation. In such cases, the investment may generate positive returns, but the purchasing power of the returns are reduced through inflation. In a study of producer attitudes towards financial management, Marker concludes producers tend to be more concerned with loss of principal than loss due to inflation. Producers must realize the impact inflation may have on their portfolios.

The extent to which an operation is affected by risk is dependent, in part, on the risk attitude of the producer. Previous studies identify three main types of risk attitudes: risk averse, risk neutral, and risk preferring (Barry; Boehlje and Eidman). Differences between each type of attitude depend on the producer's utility function for returns with respect to the risk associated with each return. The indifference curves for risk and expected returns may be derived from the producer's utility function. A risk-averse producer will have positively-sloped indifference curves for risk and expected returns which are convex to the origin. This indicates the producer must receive compensation (risk premium) to accept additional risk. A risk-neutral producer's indifference curves will have a slope of zero, indicating the producer is indifferent to additional risk. A risk-preferring producer will have negatively-sloped indifference curves which are convex to the origin. Negatively-sloped indifference curves indicate the producer is willing to pay to incur additional risk.

The shape of the indifference curves indicate the risk attitude of the producer. A producer who is extremely risk-averse will have relatively steep indifference curves compared to a less risk-averse producer. A relatively steep indifference curve indicates the producer must receive a large risk premium to accept more risk.

This study is not concerned with the producer's risk attitude towards production processes. That is, production risk associated with the operation is assumed to remain constant over all investment scenarios. However, the producer's willingness to accept risk associated with off-farm investment is analyzed in this study. Investment strategies are composed to model conservative, balanced (moderate), and aggressive producers by assuming different allocation of funds to liquid, conservative, balanced, and aggressive nonfarm investments. For example, a conservative producer is modeled by allocating off-farm investment to liquid and conservative funds, while the allocation for an aggressive producer is mainly to balanced and aggressive funds.

As a further exploration of risk, this study estimates the probability of failure of the agricultural operation (foreclosure), and the probability of meeting estimated living needs during the retirement years. These probabilities reflect the total risk facing the operation and the producer. Diversifiable and market risk are incorporated through stochastic variables.

The following section is a general summary of the major qualified retirement plans available to individuals. This summary discusses retirement plans for self-employed individuals and individuals employed by firms which provide retirement plans.

Description of Qualified Retirement Plans for Agricultural Producers

Agricultural producers have several qualified retirement plans from which to choose for their retirement portfolios. There are several types of qualified retirement plans available for producers, allowing the option of contributing for the producer, the producer and spouse, and/or the producer, spouse and eligible employees. Further, producers may be able to participate in more than one of these retirement plans at the same time.

Qualified retirement plans differ in allowable contribution limits, participant eligibility, investment vehicle options, administrative responsibilities, and tax consequences. This section provides a brief summary of the major qualified retirement plans. Information for this section is from Hoffman, Smith, and Willis; RIA; Quinn; Davenport; Scott.

Individual Retirement Accounts (IRA)

An IRA is an account that is specifically established for personal retirement investments. IRAs have been available to taxpayers since 1982. IRA accounts may be established with a bank, Federal credit union, a savings and loan association, a retirement annuity, individual retirement bonds, a trust account with an employer or employee association, or money market funds. All taxpayers who received compensation (wages, salaries, commissions, tips, bonuses, and self-employment earnings, excluding earnings from property [interest, rents, dividends], pension and annuity payments, and deferred compensation) for their services during the year and are less than 70 1/2 years of age are eligible to establish IRAs; however, employees who are covered by another qualified retirement plan may not be eligible to make tax-deductible contributions to their IRAs. They may still make non-tax-deductible contributions to their IRAs.

Tax-deductible contributions to an IRA are deductible by the individual in the year in which the contribution is made. All earnings of the IRA, whether the contributions are tax-deductible or not, grow tax-deferred until the funds are removed from the account. Annual contributions to an IRA are limited to the lesser of $2,000 or 100 percent of compensation for individuals. There is a $200 minimum tax-deductible contribution if an individual is eligible to make a tax-deductible contribution to an IRA. Any fees associated with the IRA (set-up fee, annual administrative fee, termination fees, etc.) for maintaining the IRA are not considered contributions; however, these fees are considered deductible expenses.

If an individual has a non-working spouse and is filing a joint income tax return, the individual may establish an IRA for the spouse. In this case, combined annual contributions to both IRAs are limited to a total of $2,250 or 100 percent of compensation. The $2,250 may be divided between the individual and spousal IRAs in any manner, except that no more than $2,000 may be contributed to either IRA in any year. An individual with a working spouse and files a joint income tax return may contribute up to the lesser of $4,000 or 100 percent of compensation to the individual and spousal IRAs. Again, no more than $2,000 may be contributed to either IRA in any year. Persons over the age of 70 1/2 are not eligible to make any contributions to an IRA.

The amount of the annual tax-deductible contribution may be phased out if the individual or spouse is covered by a qualified retirement plan at work. The phase out, as of 1994, is $0.20 per $1 of adjusted gross income (AGI) for individuals and married individuals with working spouses, and $0.225 per $1 of AGI for married individuals with non-working spouses. See Table 2.1 for the beginning and ending AGIs for the phase-outs for each filing status. If one spouse is not a member of a qualified plan, he/she may avoid the phase-out by filing a separate return.

Table 2.1 Adjusted Gross Income Ranges for IRA Deductions for a Taxpayer Who is a Participant of Another Qualified Retirement Plan.

Filing Status:	Phase-Out	
	Begins:	Ends:
Single/Head of Household	$25,000	$35,000
Married filing Jointly	$40,000	$50,000
Married filing Separately	$0	$10,000

If an individual is not eligible to make deductible contributions, he/she can make non-deductible contributions to a separate IRA. The limits for non-deductible contributions are the same as for deductible contributions. Thus, no more than $2,000 for individuals or $2,250 for individuals with non-working spouses. The funds in this separate account accumulate tax-free until distributed. At the time of distribution only the account earnings are taxed, as the annual contributions are made after taxes (the account basis equals the total non-deductible contributions made by the taxpayer).

A self-employed person may not make a contribution to an IRA if he/she has a net loss for the year, and has no income from other sources. Further, a net loss from self-employed activity does not reduce the amount of wages treated as compensation. Wages paid by one spouse to another are treated as earned income (assuming a true employer-employee relationship exists between the spouses), and thus make the spouse eligible to establish an IRA.

An individual is automatically 100 percent vested in an IRA, meaning he/she is entitled to the entire amount of the account. Thus, the individual does not have to meet certain requirements, as are common in corporate pension plans, in order to collect the entire amount of the IRA.

Funds cannot be withdrawn from an IRA before the individual reaches age 59 1/2 (with certain exceptions including death and disability). Premature withdrawals are subject to a 10 percent penalty tax and are taxed as ordinary income in the year of the withdrawal.

Withdrawals must begin by April 1 of the year following the year the taxpayer reaches age 70 1/2. Each distribution is treated as ordinary income for tax purposes (except for non-deductible contributions). Distributions may be in the form of a lump sum or in periodic payments. If an individual receives a lump-sum distribution, taxes on this distribution may be deferred by rolling the entire distribution over into an IRA within 60 days of the distribution. Taxes are then only paid when the funds are withdrawn from the rollover account. If an individual chooses periodic distribution payments, the period may be fixed or variable. For variable periods, the period must be determined by either the life of the participant or the joint lives of the participant and spouse. If fixed, the period may not exceed the life expectancy of either the participant or the joint expectancy of the participant and spouse.

Individuals may have IRAs even if they are member of other qualified retirement plans.

Simplified Employee Pension Plans (SEP)

A SEP is an IRA-based retirement plan developed for and written by self-employed persons for themselves and their employees. SEPs are alternatives to profit-sharing plans (to be discussed below). A major advantage of SEPs is that they involve less paperwork for the employer, and have lower cost to the employer than many other qualified retirement plans.

For tax purposes the employer is considered to be an employee. A SEP plan must cover all eligible employees who worked during the year, whether or not they are still on the payroll. Eligibility for participation may be defined by the employer; however, the minimum requirements are that the employee: (1) must have worked for the employer at any time during the year, (2) has reached age 21, (3) has worked for the employer in at least three of the past five years, and (4) has received compensation for the year of at least $385 (as of January 1, 1993, indexed for inflation). Employees who are covered by a collectively bargained agreement (unions) and nonresident aliens who do not receive compensation having its source in the US do not have to be covered in a SEP plan.

For a SEP, contributions are made to an IRA (also called a SEP-IRA) in the employee's name. Therefore the employee is responsible for overseeing the investments made with the contributions. The employer has no fiduciary responsibility in the IRAs after he/she makes the annual contribution to the employees' IRAs. The annual contributions made by the employer must be allocated to the employees as specified under a written plan. Employer contributions may not discriminate in favor of officers, shareholders, self-employed individuals, or highly-compensated employees. Further, the employer is not required to make any specific amount of contribution in any year, unless the written plan so provides. Thus, the amount of the annual contribution may fluctuate from year to year.

The maximum contribution the employer may make to an IRA for an employee is the lesser of $22,500 or 15 percent of the employee's earned income (compensation). The amount of the contribution for an employee is included in the employee's gross income for the year. The employee is entitled to tax deductions for all amounts contributed to his/her IRA that do not exceed the 15 percent of compensation/$22,500 limits. Contributions to the IRA for an employee may be reduced by the employer's share of the Social Security tax (FICA). Such plans are termed integrated plans.

For contributions made on the employer's behalf, the maximum contribution in any year is the lesser of $22,500 or 13.04 percent of self-employment earnings. [This is equal to 15 percent of after-contribution compensation, as contributions to a SEP decrease the amount of includable compensation.] The amount of the contribution for the employer must be reduced by the amount of self-employment tax. A self-employed person does not include the contribution to his/her IRA in gross income.

The employer is entitled to a deduction for contributions to employees' IRAs (including the employer) in the year in which the contributions are made. The deduction cannot exceed 15 percent of the compensation paid to the employees during the year, up to the $22,500 per employee limit. Excess contributions may be carried over to, and deducted in, subsequent years in which the contribution is smaller than the allowable amount.

As all contributions are made to IRAs, the vesting, distribution, and taxation of SEPs is the same as for IRAs. One exception to the IRA rules is that an employee may continue to deduct contributions to his/her SEP in the years after he/she reaches age 70 1/2.

SEPs are generally not combined with other retirement plans, except for regular IRAs and salary reduction SEPs (discussed below). All employees, including the employer, are entitled to a regular IRA in addition to their SEP-IRA. Thus, an employee with a SEP is allowed his/her own IRA contribution of the lesser of $2,000 or 100 percent of compensation.

Salary Reduction SEPs (SARSEP)

An alternative to a SEP plan is a SARSEP. Essentially, a SARSEP is a SEP that allows employees to contribute to their own retirement plan on a pre-tax basis. That is, the employee agrees to contribute a portion of his/her salary to the SEP-IRA. By doing so the employee reduces his/her taxable income by the amount of the contribution, up to specified limits.

An employer must meet the following guidelines in order to start a SARSEP plan. The first guideline is that at least 50 percent of the employees must participate in the plan. The employer may have to offer incentives, such as matching contributions, in order to entice the lower paid employees to participate in the SARSEP. The next guideline is requires that the employer may have no more than 25 eligible employees who worked for the employer at any time during the past year, and the employer may not have any leased employees. Finally, the employer must never have maintained a defined benefit plan for the firm.

In order to start a SARSEP, the employer must establish separate IRAs for each participant. After the IRAs are established, the employer contributes a specified amount of each employee's paycheck to the respective IRA. As with a SEP, the employer has no fiduciary concerns after making the contribution.

Employees, including the employer, may defer up to 15 percent of their compensation, up to $9,240 (as of 1994) to a SARSEP. Employees may also make after-tax contributions up to 10 percent of their compensation; however, employer and employee contributions combined cannot exceed the lesser of 25 percent of compensation (20 percent of gross income) or $22,500 in any year.

SARSEPs appeal to employers who want their employees to contribute to a retirement plan. A SARSEP is a simplified version of a 401(k) deferred compensation plan (discussed below) offered by larger firms. The advantage of the SARSEP is there less administrative effort required by the employer than in a 401(k) program. Also, as a SARSEP is a salary reduction program there is little to no cost for the employer. From the standpoint of the employees who participate in a SARSEP, they enjoy similar tax benefits to those afforded to 401(k) participants.

As with SEPs, the rules for IRAs generally apply to SARSEPs. Further, SARSEPs are generally not combined with other retirement plans except SEPs or IRAs.

Keogh Pension (H.R. 10) Plans

A Keogh Pension plan is a retirement plans for self-employed individuals. These plans have been available for sole proprietorships and partnerships since 1962. Keoghs provide a retirement plan for the employers and the employees. As with SEPs and SARSEPs, self-employed individuals are considered to be employees for tax purposes. Individuals who are covered by a qualified retirement plan through a firm and also have self-employment income may start a Keogh plan to shelter a portion of their self-employment earnings.

A variety of funding vehicles may be used for Keogh investments. The IRS approves of Keogh investments in mutual funds, annuities, real estate shares, certificates of deposit, debt instruments, commodities, securities, and personal properties. Investments in collectibles (art, coins, etc,) are not allowed in a Keogh plan. The Keogh may be managed by the participant, a banker, a broker, or a savings and loan association. Annual contributions to a Keogh plan are tax-deductible by the employer in the year in which the contribution is made. The employee receives tax-deferred growth of funds in the Keogh until the funds are withdrawn at retirement. As with an IRA, any premature withdrawal (before age 59 1/2) is subject to a 10 percent penalty tax and ordinary income tax rates.

As with other retirement plans, Keoghs have contribution limitations. The amount of deductible contributions allowed depends on the type of Keogh plan chosen by the employer (discussed below). Most of the contribution limits are based on a percentage of earned income. Earned income is defined as net earnings from self-employment (gross income derived from any trade or business carried on by an individual, less appropriate deductions, plus the distributive share of income or loss from a partnership). Further, earned income is reduced by contributions to a Keogh plan on the individual's behalf. For example, assume an individual earns $100,000 in earned income before making a Keogh contribution. The maximum contribution allowed is the lesser of 25 percent of earned income up to $30,000. As each dollar contributed to a Keogh reduces earned income, the after-contribution earned income is $80,000 [$100,000/(1+0.25)]. Thus, the maximum contribution allowable is $20,000 [$80,000 x 0.25].

There are four basic types of Keogh plans: a profit-sharing plan, a money-purchase (defined contribution) plan, a combination profit-sharing/money-purchase plan, and a defined benefit plan. A profit-sharing plan allows the employer to contribute up to the lesser of $30,000 or 15 percent of earned income (13.04 percent of gross earned income). This maximum is reduced for the employer by the amount of self-employment (Social Security) taxes paid. The actual amount contributed each year is determined by the employer. Typically, the amount of the contribution depends on the profits of the firm. The employer may decide not to make a contribution in any year.

A money-purchase (defined contribution) plan allows contributions up to the lesser of 25 percent of earned income (20 percent of gross earned income) or $30,000. In this type of Keogh, the employer chooses a contribution percentage at the beginning of the plan. The employer must make that percentage contribution each year, regardless of the profits of the firm. If, in a bad year, the employer cannot make the contribution he/she must pay a penalty to the IRS. The IRS may allow the employer to change the contribution percentage if the established percentage is causing financial hardship for the firm. This type of Keogh is common with firms that have steady earnings year after year.

A combination Keogh is a combination of a profit-sharing plan and a money-purchase plan. This type of Keogh allows the largest allowable contribution while maintaining the flexibility to change the level of the contribution as conditions merit. A combination Keogh establishes a minimum contribution as in a money-purchase plan, but allows the employer to increase the contribution when profits allow. The $30,000 limit still applies.

The fourth type of Keogh plan is the defined benefit plan. This plan establishes a fixed distribution at the time of retirement. The employer selects the amount of the pension, and then annually contributes amounts necessary to fund the pension. Actuaries are used to determine the amount of the annual contribution. The annual benefit payable to an employee under a defined benefit Keogh plan is limited to the smaller of the annual payment necessary to fund an annual benefit of $115,641 (in 1993) or 100 percent of the employee's average compensation for the 3 highest years of employment.

Corporate Pension Plans

Many firms offer their employees some form of retirement plan. These plans have collectively been termed pension plans. The benefits of pension plans are generally based on factors such as years of service with the employer and the amount of compensation received. However, the employer's contributions cannot depend on profits for most pension plans. As with Keogh plans, there are several basic forms of pension plans. The main plans are defined benefit plans, money-purchase (defined contribution) plans, Employee Stock Ownership Plans (ESOPs), and stock bonus plans.

Defined Benefit Pension Plans

As with defined benefit Keogh plans, defined benefit pension plans specify the benefit the participant will receive at retirement in fixed dollar amounts. Employees receive the stated benefits in fixed monthly payments, and they are not entitled to surplus assets in the account. All surplus assets become the property of the employer. These plans typically allow employees to contribute to their own pension fund, but this must be specified in the written pension agreement. All employees are eligible after they reach age 21 or one year of service (1,000 hour minimum), or three years of service if the plan allows for 100 percent vesting after 3 years. Vesting may occur over a five to ten year period, and must be specified in the plan. Until employees are vested, all non-elective contributions are forfeitable at termination of service.

For defined benefit plans, the limit on the annual contribution, and tax deduction, is the amount necessary to fund the benefit provided by the plan. This limit is currently the maximum needed to fund a $118,000 annuity (indexed for inflation) or 100 percent of the participant's average compensation for his/her 3 consecutive years of highest compensation. The actual amount of the contribution is typically computed by an actuary. The employer must contribute enough to cover the annual benefit at the age of retirement.

When employee contributions are allowed, the employee may make deductible voluntary contributions up to $2,000, but not more than total annual compensation. If an employee makes voluntary contributions and IRA contributions, the $2,000 ceiling on the IRA is reduced by the amount of the voluntary contribution. After-tax voluntary contributions up to 10 percent of compensation may be allowed by the plan. These contributions are non-deductible, but they will grow tax-deferred until withdrawn from the account. Employer and employee contributions combines cannot exceed 25 percent of compensation or $30,000 per participant. The contributions may be to trust or custodial accounts, insurance or annuity contracts, of face-amount certificates.

If the employer has both defined contribution and defined benefit plan, the limit on deductions is the greater of the amount allowed under the defined benefit plan or 25 percent of compensation. A 10 percent excise tax is imposed on nondeductible contributions.

Benefits from defined benefit plans must be distributed in the year the employee reaches age 65 or "normal retirement age", or the employee terminates employment with the employer. These benefits may be received as a lump-sum distribution or in periodic payments (annuity).

Money-purchase pension plans may be combined with profit-sharing plans and/or 401(k) plans. In this case the 25 percent/$30,000 limit applies to all plans in combination. Money-purchase plans may be combined with defined benefit plans, but certain restrictions may apply.

Money-Purchase (Defined Contribution) Pension Plans

With money-purchase (defined contribution) plans, the employer establishes a separate account for each participant. The written plan for the pension program defines the annual amount, either a fixed dollar amount or a percentage of compensation, the employer is required to contribute to the fund. The annual contribution is typically based on a formula that includes years of service with employer, age, and compensation. This plan may allow employees to contribute to their own pension fund as well. The benefits of a money-purchase pension plan are based solely on the amount contributed to the account and the income (or loss) from the fund that accrues to the participant's account. Money-purchase plans are typically funded through trust or custodial accounts, insurance or annuity contracts, or face amount certificates.

All employees are eligible for participation if they have reached age 21 or had one year of service (1,000 hour minimum), or three years of service if the plan allows for 100 percent vesting after 3 years. Until employees are vested, all non-elective contributions are forfeitable at termination of service.

The employer must make the specified annual contribution regardless of financial standing. Contributions to a money-purchase plan cannot exceed the lesser of $30,000 or 25 percent of employee's compensation. For self-employed individuals, the limit is the lesser of 20 percent of gross compensation or $30,000. If employee contributions are allowed, the employee may make deductible voluntary contributions up to $2,000, but not more than total annual compensation. If an employee makes voluntary contributions and IRA contributions, the $2,000 ceiling on the IRA is reduced by the amount of the voluntary contribution. Employer and employee contributions combines cannot exceed 25 percent of compensation or $30,000 per participant.

As with defined benefit plans, benefits from this type of plan must be distributed in the year the employee reaches age 65 or "normal retirement age", or the employee terminates employment with the employer. These benefits may be received as a lump-sum distribution or as an annuity.

Money-purchase pension plans may be combined with profit-sharing plans and/or 401(k) plans. In this case the 25 percent/$30,000 limit applies to all plans in combination. Money-purchase plans may be combined with defined benefit plans, but certain restrictions may apply.

Profit-Sharing Plan

A profit-sharing plan is a deferred compensation arrangement. It is the simplest and most flexible form of a qualified defined contribution retirement plan. The degree of flexibility and contribution levels are similar to SEPs, but profit-sharing plans offer more restrictive eligibility requirements and vesting schedules. This helps to minimize the costs to the employer. Further, small business owners tend to be attracted to profit-sharing plans if their profits fluctuate from year to year and the employer desires a greater degree of flexibility in the retirement plan.

Separate accounts for each participant are established and maintained by the employer to allow for the employee to receive a share of the company's profits. The plan must provide a predetermined formula for allocating the contributions among the participants. It must also include a predetermined formula for distributing the accumulated funds after a fixed number of years, on the attainment of a stated age, or on the occurrence of certain events such as illness, layoff or retirement. All full-time employees age 21 and over who have one year of service with the employer must be included in the profit-sharing plan.

The annual contributions are paid from the employer's current or accumulated profits to a trustee and are commingled in a single trust fund. The employer does not have to earn a profit for the current year to make contributions. The contribution can come from accumulated profits of the firm. The amount of the annual contribution may vary from year to year, but the employer must use the same contribution formula for each participant. The annual contribution cannot exceed the lesser of $30,000 or 25 percent of the employee's compensation. Employee's may make contributions to the account if specified in the plan. Voluntary after-tax contributions of up to 10 percent of the employee's compensation may be permitted. These contributions are not tax-deductible, but they will continue to grow tax-deferred until the funds are withdrawn from the account. Employers receive a tax deduction of up to 15 percent of the total covered payroll.

Benefits of a profit-sharing plan may be paid earlier than the benefits for other pension plans. This is due to the fact that the IRS sees profit-sharing plans as methods of compensating the employees rather than as a retirement plan. Otherwise, the distribution requirements are the same as for an IRA. All distributions (except for voluntary employee after-tax contributions) are subject to ordinary income tax. A 10 percent penalty is applied to distributions prior to age 59 1/2, except due to severance of employment after the employee attains age 55.

Graduated vesting is allowed for profit-sharing plans, unless the plan requires an eligibility requirement of greater than one year's service. In this case, the participant is fully-vested immediately upon entering the plan. If the participant is not fully-vested, any forfeited funds may be reallocated among remaining participants or they may be used to reduce employer contributions in that year.

Profit-sharing plans may be combined with defined contribution plans, 401(k) plans, and defined benefit plans (with certain restrictions). If the plans are combined, the 25 percent/$30,000 limit applies to all plans in combination.

Stock Bonus Plan

Like a profit-sharing plan, a stock bonus plan is a form of deferred compensation. The employer establishes and maintains the plan so that the firm can contribute shares of its stock for the employees' benefit. The annual contributions of stock, or cash with which to buy stock, are not dependent on the employer's profits.

Stock bonus plans are subject to the same requirements as profit-sharing plans. As with the profit-sharing plan, the annual contribution to an employee's account cannot exceed the lesser of $30,000 or 25 percent of the employee's compensation. The employer is entitled to a maximum tax deduction of 15 percent of the compensation paid to plan participants.

401(k) Plans

A 401(k) plan is a Salary Reduction Plan, also known as a Cash or Deferred Arrangement (CODA). It is a profit-sharing plan that allows eligible employees to contribute, or defer, a portion of their current earnings (salary or wages) into the plan. The employer agrees to contribute the amount of the salary reduction directly to the plan instead of paying it to the employee in the form of wages. The amount of the contributions is not included in the employee's taxable income as these contributions are made on a pre-tax basis, through a salary reduction agreement. Thus, the employee defers income taxes until retirement on these contributions and the earnings of the account; however, the annual contributions are still subject to Social Security (FICA) taxes.

Any employer with employees may establish a 401(k) plan. Generally, all full-time employees age 21 and over, and who have at least one year of service are eligible for participation.

The employer makes the appropriate contribution to a qualified profit sharing or stock bonus plan on behalf of the employee. The maximum annual deductible contribution for an employee is limited to the lesser of 15 percent of compensation up to $150,000 or $9,240 (as of 1994, indexed for inflation). This limit may be supplemented by employer matching contributions; however, the maximum of employer and employee contributions may not exceed the limits for a profit-sharing plan ($25 percent of compensation or $22,500). Integration with Social Security is not allowed, so contributions cannot be reduced by the employer's share of Social Security taxes. Elective contributions are fully-vested and are non-forfeitable.

The benefits of a 401(k) plan are not received until retirement, death, or disability, or separation from service, hardship, or age 59 1/2. Distribution must begin the year following the year the employee reaches age 70 1/2, otherwise the account faces an excise tax of 50 percent of the shortfall in distributions. As with IRAs, a 10 percent penalty applies to all premature withdrawals (with a few exceptions) and the withdrawals are subject to taxation as ordinary income. Because the participant has a zero basis in the deductible contributions, all distributions are taxed as ordinary income. Benefits may be received as an annuity or as a lump-sum distribution. These benefits are not eligible for the 5-year or 10-year averaging allowed for lump-sum distributions from other qualified retirement plans.

There has been rapid growth in this type of plan. Assets in 401(k) plans grew from $390 billion in 1993 to $475 billion in 1994 (Fiorini). This amount is projected to increase to $630 billion in 1995. A main advantage of a 401(k) is the reduced cost of the program because it is an employee-funded plan. It is also very flexible for the employer, more so than defined benefit plans.

Fiorini indicates about 75 percent of US companies allow employees to borrow from their 401(k) plans for any reason, not just in case of emergency or hardship. Most 401(k) plans allow the employee to borrow up to one-half of their account. Currently, approximately 20 percent of 401(k) participants are borrowing from their accounts. An advantage to borrowing from a 401(k) plan over a regular loan is the interest you pay on a loan from a 401(k) account goes directly into your account, not to the lender or administrator.

To borrow from a 401(k), a participant should first determine the amount of funds in the account. The IRS allows participants to borrow one-half of the total, up to a maximum of $50,000. The IRS specifies that a loan to buy a house can be repaid over either 15 or 30 years. All other loans must be repaid in 5 years. Company policy will specify how and when payments are to be made; however, the IRS requires at least quarterly payments must be made.

Tax Sheltered Annuities [403(b)]

403(b) plans are qualified retirement plans for employees of public school systems. Similar plans exist for non-profit organizations (501(c) plans), municipalities and government agencies (457 plans), and professional organizations (503(c) plans). These plans are basically defined contribution plans, in the form of salary reduction agreements. The employee agrees to have a certain amount of his/her salary contributed directly to the plan. These contributions are not subject to income tax in the year they are made; however, they are subject to Social Security (FICA) taxes. The contributions to the account grow tax-deferred until withdrawn from the account.

403(b) plans are typically funded through annuity contracts, insurance contracts providing incidental life insurance and/or qualified custodial accounts. The employer typically allows the employee to choose the particular investment vehicle. Thus, the employer has no fiduciary concerns after making the specified contribution.

The maximum annual amount of compensation an employee can defer is the lesser of $9,500 or 20 percent of includable compensation (16 2/3 percent of gross compensation). However, if employer contributions are made, the maximum total deductible contribution is the same as for a defined contribution plan (the lesser of $30,000 or 25 percent of taxable compensation). Contributions may not be reduced by the employer's share of Social Security (FICA) taxes. There are "catch-up" provisions which allow employees with 15 years of service to contribute more than the stated annual limit to compensate for years when less than the maximum contribution was made.

The vesting of a 403(b) is the same as for a 401(k) plan. The employee's contributions are 100 percent vested, while the employer's contributions may be gradually vested over a specific time period as with a profit-sharing plan.

If the plan contract permits, withdrawals are permitted at any time, for any reason, and without the 10 percent premature distribution penalty (except mutual fund custodial accounts which cannot be distributed prior to age 59 1/2, death, disability, or financial hardship). The participant is taxed on the distributions when they are received. The distributions are taxed as ordinary income.

403(b) plans may be combined with other retirement plans. However, the total contributions from all plans cannot exceed 25 percent of compensation or $30,000 per year.

Chapter 3

Model Specification and Data Requirements for the Analytical Model

"I keep trying to think, but nothin's happenin'!" Curly Joe

Chapter 3 describes the model developed to analyze various pre-retirement investment strategies for agricultural producers, and the data required to build and operate the model. The first section of this chapter provides a general overview of the analytical model and the procedures to be used in the study. The second section of this chapter provides a detailed description of the spreadsheet model used to investigate the pre-retirement investment strategies for producers. This section also documents the sources for all data used in this model. As an aid to the reader, much of the technical aspects of the model are relegated to appendices.

General Overview of the Analytical Model

The purpose of the analytical model is to simulate the impacts of various pre-retirement investment strategies on wealth accumulation and the liquidity of the producer's investment portfolio at the age of retirement, and to assess the ability of the ending portfolio to meet the producer's living needs during retirement. This is accomplished by simulating annual cash flows (farm and nonfarm) for an agricultural producer and his/her family over a 30-year planning horizon under specified investment strategies.

To model the cash flows of an agricultural operation it is necessary to specify the initial financial position and operating characteristics of the operation. The main parameters used to specify the financial position of the operation are beginning farm assets, beginning nonfarm assets, and beginning liabilities. The operating characteristics of the operation are specified by natural capital replacement rate, depreciation expense ratio, and various farm investment preferences of the operator. These parameters define the initial conditions and operational controls under which the business will operate.

To add realism to the model, eight variables used to determine the operation's annual cash flows are stochastically generated. These variables, listed in Table 3.1, are generated in a manner that captures the cyclical nature of these variables and their correlation with other stochastic variables. The stochastic rates are obtained by modeling the historical rates for the period 1940-1988, as obtained or calculated from Agricultural Statistics and Economic Report of the President. This is accomplished by modeling these variables using a 2-lag vector-autoregressive (VAR) model. The stochastic variables used by the simulation model area generated by adding a randomly-generated error to the predictions from each of the equations of the VAR model. The errors are assumed to be distributed multivariate normal with zero means and a variance-covariance matrix equivalent to the estimated VAR residual variance-covariance matrix (See Appendix A for details). A 30-year time series is generated for each variable listed in Table 3.1.

Table 3.1 Stochastic Variables Used in the Simulation Model

Farm Revenues as a Percent of Total Farm Assets
Farm Cash Expenses as a Percent of Total Farm Revenues
Rate of Return to Farm Land
Rate of Return for the Liquid Asset Account
Rate of Return for the Balanced Account (Beta = 1.0)
Long Term Interest Rate (Federal Land Bank)
Intermediate Term Interest Rate (Production Credit Association)
Nominal Inflation Rate

The annual cash flows modeled in this study include farm and nonfarm cash flows. Cash flows for the operation consist of farm revenues and expenses, cash capital purchases, interest and principal payments, retirement investment, and self-employment taxes. Farm revenues, farm expenses, interest and principal payments are stochastically-generated using the simulated rates listed in Table 3.1. Nonfarm cash flows consist of revenues from a nonfarm job, interest (dividend) income, nonfarm investments, family living expenses, and income taxes. Nonfarm revenues and family living expense are specified by the user. Other cash flows calculated by the model include income and self-employment taxes, cash capital purchases, and interest (dividend) income.

The basic function of the analytical model is to generate the annual cash flows for the operation and adjust the ending asset and liability account balances to reflect the results of each year's operations. This process is continued for a 30-year planning horizon. As stated above, 100 replications of each investment scenario are simulated, with each replication using a different matrix of stochastically-generated rates.

The first phase of the model is generation of the annual cash flows. The annual cash inflows are farm revenues, nonfarm revenues, and dividend income. To calculate the annual income and self-employment tax liability it is necessary to calculate net farm income by subtracting farm expenses from farm revenues. Annual farm revenues for any given year are estimated by multiplying the stochastically-generated farm revenues as a percent of farm assets by the beginning farm assets for that year. Cash farm expenses, excluding interest expense, are determined through use of a stochastically-generated cash expense-cash receipt ratio. Annual interest expense is calculated based on an amortization schedule for term debt, and the annual interest expense on operating debt. Non-cash farm expenses include depreciation and IRS Code Section 179 expenses. Annual depreciation is estimated to be 1 percent of total farm assets. Section 179 allows capital purchases to be written off as expenses in the year of purchase rather than depreciating these capital purchases. Annual Section 179 expense is the maximum amount allowed by the IRS tax code ($17,500 as of 1994). The resulting figure is net farm income.

After calculating net farm income, all relevant information is exported to a tax calculation spreadsheet. This spreadsheet calculates the Federal self-employment taxes for the operation based on the Federal Schedule SE (Form 1040). The next phase is calculation of the income tax liability for the operator and dependents. This phase determines taxable income, maximum allowable deductible IRA contribution, and total income tax liability. Adjustments for pre-tax retirement investments (IRAs, SEPs, and 401(k)s) are made to taxable income depending on the specified investment scenario. All calculations are based on the U.S Individual Income Tax Return (Form 1040).

Total tax liability is subtracted from net cash inflows to determine the cash margin available for debt service, family living, and investment. Scheduled principal payments on term debt and operating loans are subtracted from the margin, as is the annual family living expense. The final adjustment is to subtract the amount of cash used for natural capital replacement, and to add the amount of new term debt obtained for natural capital replacement. The resulting figure is the cash margin available for investment. This margin may be used in 5 ways: 1) investment in the operation, 2) to build liquidity, 3) investment in a taxable portfolio, 4) used for excess family living, or 5) used to prepay term debt. The exact proportion of the cash margin invested in each of these uses is specified by the investment scenario.

Once these cash flows are estimated, the ending account balances for all assets and liabilities are adjusted. Each asset account is adjusted for purchases, liquidation, inflation, and/or capital appreciation. Further, the non-land farm asset accounts are adjusted for annual depreciation. The liability accounts are adjusted for principal repayment and new borrowing.

The above process is repeated each year for a 30-year planning horizon. At the end of the 30-year period the ending asset and liability accounts are recorded for that replication of the specified investment scenario. After the results from the first replication are recorded, the spreadsheet template is reset and the next replication of the same investment scenario begins. This occurs for 100 replications for each investment scenario.

Thirty-two investment scenarios are analyzed (See Table 3.2) for three different capitalization methods. Each investment scenario differs with respect to retirement category, investment strategy, and use of the cash margin available for investment (cash preference). The three capitalization methods are:

Case I - Producer with a 50 percent debt/asset ratio
Case II - Producer with a 65 percent debt/asset ratio
Case III - Producer who leases a majority of his/her land, with a 65 percent debt/asset ratio

These cases allow analysis of different methods of capitalization on retirement planning. The thirty-two scenarios for each case are divided into four retirement

Table 3.2 Schematic of 32 Investment Scenarios Analyzed

		Retirement Category			
Investment Strategy	Cash Preference	NONE	IRA	SEP	ALL
Conservative					
	Farm	Scenario 1	Scenario 9	Scenario 17	Scenario 25
	Debt	Scenario 2	Scenario 10	Scenario 18	Scenario 26
Balanced					
	Farm	Scenario 3	Scenario 11	Scenario 19	Scenario 27
	Debt	Scenario 4	Scenario 12	Scenario 20	Scenario 28
Aggressive					
	Farm	Scenario 5	Scenario 13	Scenario 21	Scenario 29
	Debt	Scenario 6	Scenario 14	Scenario 22	Scenario 30
Dynamic					
	Farm	Scenario 7	Scenario 15	Scenario 23	Scenario 31
	Debt	Scenario 8	Scenario 16	Scenario 24	Scenario 32

investment categories. These categories differ in their use of retirement investment vehicles. Specifically, the four retirement investment categories are:

NONE	- No retirement investment vehicles allowed
IRA	- Use of IRAs for producer and spouse
SEP	- Use of IRAs (producer and spouse) and a SEP for producer
ALL	- Use of IRAs, a SEP (producer only), and 401(k)s for producer and/or spouse

Scenarios within each retirement category differ with respect to the investment strategy of the producer, and the use of the cash margin for reinvestment in the farm versus prepaying term debt (cash preference). Four classes of producer investment strategies are defined: 1) conservative, 2) balanced, 3) aggressive, and 4) dynamic (changing from aggressive to conservative over time). Each investment strategy is modeled by specifying different levels of investment in liquid, conservative, balanced, and aggressive portfolios. The investment mix remains static over the entire planning period for the conservative, balanced, and aggressive preferences. For the dynamic investment strategy, the producer is assumed to have an aggressive investment strategy for the first ten years of the planning horizon, a balanced investment strategy for the second ten-year period, and a conservative investment strategy for the final ten-year period.

The use of the cash margin available for investment in the farm operation versus prepayment of debt (cash preference) is the second major difference between scenarios within each retirement category. The cash margin available for investment is divided between farm investment, building liquidity, taxable investment, family living and prepayment of debt by specific proportions. For this study, 30 percent of the margin is allocated equally to building liquidity, taxable investment, and family living expense for every investment scenario. For Cases I (50 percent debt/asset ratio) and II (65 percent debt/asset ratio) the remaining 70 percent is divided between investment in the operation and debt prepayment. Two cash priorities are specified for each investment strategy as follows:

FARM - 75 percent for farm investment/25 percent for debt prepayment, or
DEBT - 25 percent for farm investment/75 percent for debt prepayment

For Case III (producer who leases), the only investment in the farm is for natural capital replacement. Ten percent of the investment margin is allocated to excess family living, and 10 percent is allocated to the taxable portfolio. The remainder of the investment margin is divided in the following manner for Case III:

LIQUID - 75 percent in liquid account/25 percent for debt prepayment, or
DEBT - 25 percent in liquid account/75 percent for debt prepayment

The 32 investment scenarios allow a general investigation of the impacts of various investment strategies on the financial position of the business and the family. This design allows analysis of differences between investment scenarios within each of the four retirement investment categories, as well as analysis of the differences between each of the four retirement investment categories. For example, it is possible to analyze differences in average ending net worth for the family due primarily to the use of different retirement investment vehicles. It will also be possible to analyze the differences in the distribution of ending net worth due to different investment strategies and/or cash priorities assuming a certain retirement investment (eg. IRAs) is used. The simulation scenarios also enable the estimation of the risk involved in operating the farm under various combinations of retirement category, investment strategy, and cash preference. Risk is measured in terms of probability of liquidation (failure) of the farm business. The farm business is considered to be a failure if the debt/asset ratio exceeds 75 percent. Estimating the probability of failure for each scenario and each capitalization case allows analysis of the impacts of different investment strategies on the risk associated with the farm business.

The model is also capable of measuring the success of the producer's retirement planning in meeting the living needs of the family during the retirement years. Three levels of annual income required to meet living needs during the retirement years are assumed. Annual cash inflows during retirement are generated from rental of farm assets, Social Security benefits, and from an annuity purchased with the producer's ending nonfarm net worth (including proceeds from IRAs, SEPs, and 401(k) plans). The producer is considered to be successful if total annual cash inflows are greater than living needs during retirement. The model reports three measures of interest in this area: 1) probability of meeting living needs during retirement, 2) average annual income available during retirement, and 3) average annual income as a percent of estimated living needs during retirement.

The agricultural operation modeled in this study is not state-specific or enterprise-specific (dairy, cash grain, etc.). Thus, the results of the model may be applied in a general fashion to any agricultural operation. The operation modelled in this study is assumed to be newly-purchased by the producer. The producer has a beginning farm asset base of $1 million which generates annual gross revenues of $140,000 to $310,000 as determined by a stochastic rate of farm revenues as a percent of total farm assets. The operation in Case I has a beginning debt/asset ratio of 50 percent, while the beginning debt/asset ratio for Cases II and III is 65 percent. The producer is assumed to be married, with 2 dependents. Further, the producer's spouse is assumed to earn income from an off-farm job.

The analytical model developed for this study is a spreadsheet simulation model (developed in LOTUS for Windows, Release 4). The model consists of five linked-spreadsheet files: INFOSEXN, TAXFORMS, LOANCALC, ESTRATES, and RETIRE. This system of spreadsheets simulates the cash flows and investment strategies for the given farm operation over a 30-year period. The cash flows include nonfarm income, farm revenues and expenses, principal and interest payments, income and self-employment taxes, family living expenses, and nonfarm investments, including investments in the major retirement plans.

INFOSEXN is the primary spreadsheet in the system. This spreadsheet allows the user to define the operating characteristics of the producer and his/her agricultural operation. It also contains the cash flow generator, the asset and liability accounts, and the results section for the entire system. TAXFORMS calculates the annual Federal self-employment and income tax liability for the producer. LOANCALC amortizes each loan over the entire planning horizon. RETIRE estimates the ability of the producer to meet his/her living needs during the retirement years. This spreadsheet estimates a probability of success in meeting family living needs, and it provides an estimate of the maximum annual cash inflow available during retirement. ESTRATES contains the forecasts of rates of return, interest rates, and other rates over a 30-year period for 100 replications. The cash flow generator in INFOSEXN utilizes these simulated rates of returns and/or interest rates for various investments to determine cash inflows (farm revenues and dividend income), cash outflows (farm expenses and interest payments), and changes in asset values due to capital appreciation and inflation. These simulated rates are generated by a vector-autoregression (VAR) model based on historic rates for the period 1940 to 1988 (See Appendix A for details of the VAR model).

Description of INFOSEXN

INFOSEXN (Information Section) is the primary user file in the model. This file has four main functions: 1) specification of the operation and investment strategies, 2) cash flow simulation, 3) maintenance of asset and liability accounts, and 4) reporting summary statistics from each simulation.

Specification of the Operation and Investment Scenarios

INFOSEXN allows the user to define the beginning condition of the farm operation and to control the manner in which investments are made throughout the planning horizon (See Table 3.3). The operation is defined by several parameters, including operator characteristics, operation characteristics, and investment strategy. Operator characteristics include age, spouse's age, number of dependents, nonfarm income, family living expense, tax information (eg. filing status), and preference for obtaining an operating loan versus liquidating assets to cover cash deficits.

Three producer cases are modelled in this study. Case I models an operator who owns a majority of his/her assets and has a 50 percent debt/asset ratio. Case II assumes an operator who owns a majority of his/her assets and has a 65 percent debt/asset ratio. Case III models an operator who leases a majority of his/her assets and has a 65 percent debt/asset ratio.

The operator and spouse in this study are assumed to be 35 years of age, have two dependents, and earn nonfarm income of $25,000 (White). Nonfarm income is assumed to increase at the average rate of inflation for each replication. Family living expense is assumed to be $30,000 per year (White). The number of dependents, not including the spouse, is reduced to zero when the operator reaches age 50. This assumption reflects the tax implications of no longer being able to claim children as dependents as they grow older. The operator's tax filing status is married/joint return. The spouse is considered to be a working spouse and is assumed to be covered by a qualified retirement plan at the nonfarm job. The operator is assumed to prefer liquidating his/her liquid assets (savings account) to obtaining an operating loan for cash deficits. The user may alter these parameters to model different family situations.

Table 3.3 Variables Used to Specify the Producer and Operation

Farm Information:
- Beginning Asset Account Balances
- Beginning Liability Account Balances
- Farm Depreciation Expense Percentage
- Natural Capital Replacement Rate
- Proportion of Capital Purchases paid in Cash vs. by Loan
- Preference for Liquidating Liquid Assets vs. Obtaining an Operating Loan (0 = Operating Loan, 1 = Liquidate)
- Farm Asset Investment Percentages (Livestock, Machinery, & Equipment; Non-Land Real Estate; Farm Land)

Tax Information:
- Current Ages of Producer and Spouse
- Filing Status for Federal Taxes
  - 1 = Single
  - 2 = Married Filing Jointly
  - 3 = Married Filing Separately
  - 4 = Head of Household
  - 5 = Qualifying Widower
- Working Spouse (0 = No, 1 = Yes)
- Covered by Qualified Pension Plan (0 = No, 1 = Yes)
- Participation in SEP/Keogh/401(k)/403(b) Retirement Plans
- Number of Exemptions

Other Information:
- Gross Nonfarm Income for Producer and Spouse
- Normal Annual Family Living Expense
- Investment Percentages for Margin Available for Investment (Invest in Farm, Liquid Assets, Taxable Portfolio, Family Living Expense, Pay Down Debt)
- Taxable Portfolio Investment Percentages (Liquid Assets, Conservative Assets, Balanced Assets, Aggressive Assets)
- IRA Investment Percentages (Liquid Assets, Conservative Assets, Balanced Assets, Aggressive Assets)
- Keogh/SEP Investment Percentages (Liquid Assets, Conservative Assets, Balanced Assets, Aggressive Assets)
- 401(k)/403(b) Investment Percentages (Liquid Assets, Conservative Assets, Balanced Assets, Aggressive Assets)

The agricultural operation is characterized by:

a. beginning farm asset accounts (machinery/livestock, non-land real estate, farm land, and section 179 assets),
b. beginning farm liability accounts,
c. farm depreciation expense ratio,
d. natural capital replacement rate,
e. investment percentages for machinery/livestock, non-land real estate, and land,
f. the operator's preference for liquidating assets versus obtaining an operating loan, and
g. the proportion of capital purchases paid in cash versus obtaining term debt.

The operations modelled in Case I and II are assumed to have beginning farm assets of $1 million, divided as follows:

a. beginning machinery/livestock account of $150,000,
b. beginning non-land real estate account of $140,000,
c. beginning farm land value of $710,000, and
d. beginning section 179 asset account of $0.

These values are based on national averages as reported in Farm Operating and Financial Characteristics, 1990. On average, machinery and livestock typically comprise 15 percent of total farm assets, non-land real estate account for 14 percent of total farm assets, and land accounts for 71 percent of total farm assets. The beginning liability account, a combination of intermediate and long-term liabilities, is assumed to be $500,000 for Case I and $650,000 for Case II. These values reflect debt/asset ratios of 50 percent and 65 percent, respectively. These debt/asset ratios are not unusual for a relatively young farm operator. For Case III, the operator is assumed to have:

a. beginning machinery/livestock account of $150,000,
b. beginning non-land real estate account of $140,000,
c. beginning farm land value of $210,000, and
d. beginning section 179 asset account of $0.

This operator is assumed to have $325,000 in beginning term liabilities, reflecting a debt/asset ratio of 65 percent.

New investment in farm assets is divided into four categories: 1) section 179 assets, 2) machinery/livestock, 3) non-land real estate, and 4) farm land. The section 179 assets account represents assets which are expensed under the provisions of IRS Code Section 179. These assets must be separated from other farm assets to avoid "double-counting" during the depreciation expense calculation. Only farm assets which are purchased due to natural capital replacement (before-tax) are included in section 179 assets. The maximum allowable section 179 deduction is taken each year. New pre-tax investment in the farm is divided as follows for Cases I and II: 71 percent for machinery/livestock, 22 percent for non-land real estate, and 7 percent for land. These percentages reflect new investment as a percent of total farm assets as reported in Farm Operating and Financial Characteristics, 1990. For the leasing case (Case III) the percentages for reinvestment are 80 percent for machinery/livestock, 20 percent for non-land real estate, and 0 percent for land. All after-tax investments in the farm are assumed to depreciate starting in the following year. No after-tax investments are included in the annual section 179 deduction. Thus, after-tax investments in the farm have no tax consequences in the year of purchase.

Before-tax investment in the farm occurs at the natural capital replacement rate. This rate reflects investment in the farm to replace equipment which has fully depreciated and investment for growth in the farm. The natural capital replacement rate used in Cases I and II is 2 percent of total farm assets. This rate is the average new annual investment for all farm sizes as reported in Farm Operating and Financial Characteristics, 1990. The natural capital replacement rate for Case III is 1 percent. This rate matches the annual depreciation expense rate for the operation. In essence, for the leasing case, the only reinvestment in the operation is to replace depreciated assets.

Another characteristic of the operation is the annual depreciation expense rate. This rate represents the annual tax-deductible depreciation of farm assets, not including assets expensed under section 179. This estimate of tax depreciation is also used as a proxy for physical depreciation when adjusting the farm asset accounts. The depreciation expense ratio for this operation is assumed to be 1 percent of total assets. This rate is an average of annual depreciation expense as a percent of total farm assets (not including section 179 assets) for all farm sizes (Farm Operating and Financial Characteristics, 1990).

INFOSEXN allows specification of the producer's preference for liquidating the liquid asset account versus obtaining an operating loan to cover cash deficits for the year. This is a 0-1 variable. A value of one indicates, in the presence of a cash deficit, the producer would rather liquidate the liquid assets to cover the deficit. If the liquid asset account does not contain enough funds to cover the deficit an operating loan will be obtained. A value of zero indicates the producer's preference of obtaining an operating loan to cover any cash deficit. It is assumed operating loans can be obtained each year if necessary.

The final user-specified characteristic of the operation is the proportion of before-tax capital purchases paid in cash. The percentage of cash purchases in this study is 25 percent, reflecting a 25 percent down payment requirement. Again, the user may alter any of these parameters to reflect differing operating characteristics.

Investment strategies are specified by the user in several ways. The first investment strategy concerns the use of the cash margin available for investment. This margin, which is generated by the cash flow generator, represents the amount of cash available for investment after all expenses, taxes, retirement investments, and scheduled debt service payments are made. The margin may be allocated to five different uses:

a. Reinvestment in the farm (after-tax)
b. Invested in the liquid asset account
c. Invested in a taxable portfolio
d. Used for family living in excess of normal allocations
e. Used to pre-pay term debt

The user specifies how the margin is to be allocated amongst these uses through percentages. For example, 20 percent of the margin may be allocated for each use. Altering the percentage of the margin allocated to each of these areas allows analysis of the effects of differing cash investment strategies.

After-tax reinvestment in the farm is allocated similarly to the purchase of farm assets as part of natural capital replacement. The amount allocated to after-tax reinvestment in the farm is divided between machinery/livestock, non-land real estate, and farm land as previously discussed. Again, there are no tax consequences of these farm investments in the year of purchase. Depreciation on these assets is calculated beginning in the year after purchase.

Investments in the liquid asset account represent funds deposited to a savings account or money-market checking account. This study assumes 10 percent of the cash margin available for investment is invested in the liquid asset account. The yield of the liquid account is assumed to be comparable to the rate of return on US Treasury Bills (Ibbottson). The annual rates earned on the liquid account are stochastic, as simulated in the VAR model.

Investments in the taxable portfolio represent investments in securities such as stocks, bonds, mutual funds, etc. All dividends and earnings from this portfolio are taxable; however, capital appreciation of the portfolio is not subject to taxation until the assets are sold. As with the liquid asset account, 10 percent of the cash margin available for investment is invested in the taxable portfolio. The taxable portfolio is comprised of four different classes of investments: liquid asset account, conservative account, balanced account, and aggressive account. These accounts may best be thought of as different risk-classes of mutual funds. The annual rates of return for the balanced account are stochastic, as generated by the VAR model. The rates of return used in the VAR model are the annual rates of return as measured by the Standard & Poor (S&P) 500 Index (Ibbottson). The balanced account is assumed to move directly with the S&P 500 Index; thus, it has a beta coefficient of 1.0. The conservative account is assumed to move at a rate of one-half of the market; thus, the conservative account is assumed to have a beta coefficient of 0.5. The annual rate of return on the conservative account is calculated by multiplying the stochastic rate of return on the balanced fund by the beta coefficient for the conservative account (0.5). The aggressive account is assumed to move at 150 percent of the S&P 500 Index; thus, it has a beta coefficient of 1.5. The annual rate of return for the aggressive account is obtained by multiplying the stochastic rate of return for the balanced account by the beta coefficient for the aggressive account (1.5).

The investment margin may also be used for excess family living consumption. Examples of such "excess" expenses may be vacations, capital purchases such as televisions or satellite dishes, or extra expenditures for groceries, clothing, or entertainment. The percentage of the cash margin used for normal family living expense is assumed to remain constant at 10 percent.

Pre-payment of term debt is the final use of the investment margin. Excess cash may be used to pay down existing term debt. Pre-payment of debt occurs in LOANCALC, thus adjusting the principal and interest payments for the remaining years of each loan. Pre-payments are treated in a first-in, first-out (FIFO) manner; thus, all pre-payments are used to pay down the oldest term debt first. Note that funds allocated to this activity may not be used if there is no existing term debt. In this case, unused funds are invested in the liquid asset account.

Each of the investment scenarios involves allocation of the investments in the four risk classes (liquid, conservative, balanced, aggressive) for the taxable portfolio, as well as the IRA, SEP/Keogh, and 401(k)/403(b) accounts. Altering the percentage of investment in each risk category allows analysis of the effects of differing investment strategies on financial condition and performance. This study analyzes four investment strategies: conservative, balanced, aggressive, and dynamic. The conservative attitude assumes an allocation of 50 percent of the investment to the liquid account and 50 percent to the conservative account. The balanced attitude assumes a balanced portfolio with 25 percent of the investment in each of the four risk class accounts. The aggressive attitude assumes 50 percent of the investment is allocated to the balanced account and 50 percent to the aggressive account. These allocations are assumed to remain constant over the entire planning period.

Further analysis of investment strategies is enabled by altering the above allocations over the planning period. Popular press articles suggest individuals typically start with an aggressive attitude and become more conservative in their investments as retirement age approaches. The dynamic investment strategy modeled in this study assumes the operator adopts an aggressive investment attitude during the first 10 years of the planning period, a balanced investment attitude during the second 10 years, and a conservative investment attitude during the final 10 years of the planning period.

Cash Flow Simulation

INFOSEXN contains a cash flow generator which simulates the annual cash inflows and outflows for the operation and the operator's family. After simulating these cash flows, the cash flow generator determines the cash margin available for investment. To simulate the annual cash flows, INFOSEXN imports vectors of 8 stochastic rates of return and interest rates from ESTRATES. Each vector consists of simulated rates of return for a 30-year period. These simulated rates are generated by the vector-autoregressive (VAR) model discussed in Appendix A. Table 3.1 lists the rates which are simulated in this study. To generate a distribution of possible outcomes, 100 replications are performed for each investment scenario. Each replication uses a different 30 x 8 matrix of stochastic rates.

The cash flow generator determines all cash inflows to the producer. These inflows include nonfarm revenue, taxable dividend income from nonfarm investments, and total farm revenues. Dividend income is calculated by multiplying the account balances for the liquid asset account and the taxable portfolio by their respective dividend ratios. The dividend ratios used for this study are:

Liquid Asset Dividend Ratio = 0 percent (growth only)
Conservative Account Dividend Ratio = 8.42 percent
Balanced Account Dividend Ratio = 4.40 percent
Aggressive Account Dividend Ratio = 2.09 percent

These dividend rates are averages of 20 randomly-selected funds for each class of investment (Wiesenberger). Dividend rates for the conservative account are from government security and corporate bond funds. The dividend rates for the balanced account are from balanced funds and growth and current income funds. The aggressive account dividend rate is compiled from long-term growth and maximum capital gains funds. It is assumed that all dividends are taxed and then treated as cash inflows for the investment margin. Dividends are not automatically reinvested into the account from which they came.

Annual cash farm revenues are calculated by multiplying the total farm assets (including section 179 assets) by the stochastic farm revenues as a percent of total farm assets for that year. The stochastic farm revenues as a percent of total assets are obtained by modeling the historical rates for the period 1940-1988 as calculated from

Agricultural Statistics and Economic Report of the President. For Case III (Leasing) annual cash revenues as a percent of total assets is assumed to be double the cash revenues as a percent of total assets for Cases I and II due to the leasing of equipment and land. This reflects generation of similar revenues with less owned assets.

The cash outflows calculated by the cash flow generator include cash farm expenses (excluding interest); interest payments; natural capital replacement; income and self-employment taxes; IRA, SEP/Keogh, and 401(k)/403(b) contributions; normal family living expenses; scheduled principal payments; and repayment of operating loans. The cash flow generator also calculates the annual depreciation expense for the operation to calculate net farm income.

Annual farm cash expenses are calculated by multiplying the simulated cash expense/cash receipt ratio by total farm revenues. The stochastic farm cash expense/cash receipt ratios are obtained by modeling the historical rates for the period 1940-1988 as reported in Agricultural Statistics and Economic Report of the President. For Case III (Leasing), the cash expense/cash receipt ratio is increased by 7 percentage points to reflect the land lease expenses (Kohl).

Interest expense for the operation includes interest on term debt and operating loans. The stochastic interest rates for operating loans and intermediate term debt are obtained by modeling the historical Farm Credit Production Credit Association interest rates for the period 1940-1988 (Agricultural Statistics). The long-term interest rates are simulated by modeling the Federal Land Bank interest rates from 1940-1988 (Agricultural Statistics). Annual interest expense for the operating loans is calculated by multiplying the operating loan by the stochastic interest rate for that year. Operating loans and the annual interest expense for the operating loan are assumed to be repaid each year. Interest for term debt is calculated in LOANCALC, as discussed below. LOANCALC also determines the scheduled annual principal payment for each term loan.

Table 3.4 Maximum Allowable Annual Contributions to Major Retirement Plans

Retirement Plan	Maximum Allowable Annual Contribution
IRA	100% of compensation, up to $2,000
SEP	15% of compensation, up to $22,500
Keogh	25% of compensation, up to $30,000
401(k)	15% of compensation, up to $9,240
403(b)	20% of compensation, up to $9,500

Combination of all retirement accounts (excluding IRAs) cannot exceed $30,000

Cash requirements for natural capital replacement are determined by multiplying the amount of capital purchases for natural capital replacement by the "down payment" rate discussed earlier. The rate used for this study is 25 percent. For example, if natural capital replacement for the year is $10,000, the cash requirement is $2,500.

Annual Federal income and self-employment taxes are calculated in TAXFORMS and imported into the cash flow generator. The income and self-employment taxes are reduced by the contributions to the various retirement plans (IRAs, SEP/Keoghs, 401(k)/403(b)s). Annual contributions to these plans are assumed to be the maximum allowable amount under the 1993-94 IRS tax code. All retirement plan contributions are assumed to be made before all other cash outflows. The maximum annual IRA contribution is the maximum allowable deductible amount, as calculated in TAXFORMS. Non-deductible contributions are not considered in this study. The maximum annual SEP/Keogh and 401(k)/403(b) contributions are listed in Table 3.4.

Normal annual family living expense reflects the yearly expenses incurred to support the operator's family. These expenses include food, health insurance, clothing, and education expenses, to name just a few. Annual family living expense is assumed to be at $25,000. This is an average of national family living expenses as reported by White. Family living expense is assumed to increase each year by the average inflation rate for each replication.

Calculation of Cash Margin Available for Investment

The cash margin available for investment is the amount of cash remaining after all cash outflows have been subtracted from the total cash inflows. This margin is calculated in a systematic fashion to correctly incorporate tax liabilities and retirement investment consequences. The following is a description of the calculation of this margin.

The first step in calculating the margin is to determine total cash inflows. These consist of gross nonfarm income, taxable interest income, and gross farm revenues, as discussed above.

The next phase of adjustments allows the calculation of net farm income. Total farm-related expenses (cash farm expenses, interest expense, depreciation, section 179 expense, and SEP/Keogh contributions) are subtracted from gross farm revenue for each year. Net farm income is then exported to TAXFORMS to enable calculation of the self-employment and income tax liability for the operation.

Further adjustments required for the calculation of the annual tax liability include subtraction of IRA and 401(k)/403(b) contributions. After these deductions are considered, TAXFORMS calculates the total tax liability for the year. Total tax liability is then exported to INFOSEXN in order to continue with the calculation of the investment margin.

The remaining adjustments required for the calculation of the cash margin include the subtraction of scheduled principal payments, repayment of the operating loan, cash purchases for natural capital replacement, and normal family living expense. The resulting figure is the cash margin available for investment. If the resulting figure is negative an operating loan in the amount of the deficit is obtained; thus, the cash margin available for investment is equal to zero.

Maintenance of Asset and Liability Accounts

Maintenance of the asset and liability accounts is necessary to track financial performance over time as well as to provide information required by the cash flow generator. Table 3.5 lists the asset and liability accounts utilized in the simulation model. This section provides a general overview of the basic procedures for adjusting the accounts.

Adjustments to the farm asset accounts include depreciation, inflation, and purchases. The first adjustment is to subtract annual depreciation from the beginning accounts for machinery/livestock, non-land real estate, and section 179 assets. As stated above, tax depreciation is used as a proxy for physical depreciation. Depreciation expense for machinery/livestock and non-land real estate is pro-rated according to the ratio of each account to total depreciable assets. That is, machinery/livestock depreciation is estimated by multiplying total depreciation by machinery/livestock as a percent of total depreciable assets. Depreciation is subtracted from section 179 assets because these assets, while not eligible for tax depreciation, are physically depreciating over time. Depreciation for the section 179 assets is estimated at 1 percent of the value of the assets.

The next adjustment is the inflation of these farm accounts by the simulated inflation rate for each year. Simulated inflation rates are based on annual inflation rates for the period 1940-1988. (Ibbottson) This procedure is necessary to keep all dollar amounts in nominal terms.

The final adjustment to the machinery/livestock, non-land real estate, and section 179 assets is to add annual purchases to each account. This adjustment produces the ending balance for each year in the simulation.

Table 3.5 Asset and Liability Accounts Utilized in the Simulation Model

Asset Accounts:

Farm Machinery and Equipment
Farm Real Estate (non-land)
Farm Land
Section 179 Assets
Liquid Assets
Taxable Portfolio
- Liquid Assets
- Conservative Assets (Beta = 0.5)
- Balanced Assets (Beta = 1.0)
- Aggressive Assets (Beta = 2.0)

Deductible IRAs for Producer and Spouse
- Liquid Assets
- Conservative Assets (Beta = 0.5)
- Balanced Assets (Beta = 1.0)
- Aggressive Assets (Beta = 2.0)

SEP/Keogh Retirement Accounts
- Liquid Assets
- Conservative Assets (Beta = 0.5)
- Balanced Assets (Beta = 1.0)
- Aggressive Assets (Beta = 2.0)

401(k)/403(b) Retirement Accounts for Producer and Spouse
- Liquid Assets
- Conservative Assets (Beta = 0.5)
- Balanced Assets (Beta = 1.0)
- Aggressive Assets (Beta = 2.0)

Liability Accounts:

Short Term Liabilities (Operating Loans)
Term Liabilities

Farm land is treated in a slightly different manner than the other farm asset accounts. Land is a non-depreciable asset; therefore, no adjustment for depreciation is made in the farm land account. Further, there is no adjustment for inflation in this account. Instead, the farm land account is increased (or decreased) by the simulated rate of return on land for each year. These simulated rates of return for farm land are based on annual changes in farm land values for the 1940-1988 period, as reported by Jones and Canning. Jones and Canning only report changes in farm land values for 1950-1992. However, they report their method for estimating the changes in land values. Thus, a similar procedure is used to calculate the land value changes for the period 1940-1949. After adjusting the farm land account for capital appreciation, the final adjustment in the account is to add annual farm land purchases.

The taxable portfolio accounts (the liquid, conservative, balanced, and aggressive accounts) are adjusted in a similar manner to the farm land account. The accounts are adjusted for capital appreciation by utilizing the simulated rates of return (capital growth) for each account. After adjusting for capital appreciation, all purchases are added to their respective accounts. The annual dividend for each account is calculated, but not included in the account balance as these dividends are treated as taxable income. The annual dividend is calculated by multiplying the beginning account balance by the dividend payout rate for that account. This dividend is treated as interest income in the cash flow generator.

The retirement accounts (IRA, SEP/Keogh, 401(k)/403(b)) are handled in a similar manner as the taxable portfolio, with the exception of the annual dividends. The dividends earned by the retirement accounts are reinvested, tax-deferred, into the respective retirement account due to the fact that growth (including dividends) in retirement accounts is not taxed until the funds are withdrawn from the account.

The adjustments to the liability accounts are straight-forward. The operating loan account is simply the operating loan obtained that year. This is because the operating loan is assumed to be repaid in full each year. The term debt account is adjusted with the aid of LOANCALC. This account is reduced by the amount of principal repaid during the year, and increased by the amount of new term borrowing for the year.

Summary Statistics from INFOSEXN

The final function of INFOSEXN is to report the summary statistics from the simulation procedure. The statistics reported include: the ending account balances for the thirtieth year for each replication; the present value of the cumulative tax liability for each replication; the mean, sample standard deviation, maximum, and minimum for all 100 replications; the probability of failure of the operation; and summary statistics from RETIRE (discussed below).

The mean ending account balances for each scenario are used to compare the effects of different retirement investment strategies. These balances allow comparison of wealth accumulation and the level of liquidity at retirement age for each of the scenarios.

The sample standard deviation, maximum, and minimum for each account provides a general measure of the risk associated with the different investment strategies. Further measures of risk include the probability of failure of the operation and the probability of meeting estimated living needs during retirement (as calculated in RETIRE). The probability of failure is a measure of the risk of operating an agricultural business. An operation is considered to fail when the debt/asset ratio rises above a user-defined level. This study uses 75 percent as a limit on the debt/asset ratio. Thurgood and LaDue report a mean minimum equity percentage required by clients of surveyed banks of 37 percent. This equates to a maximum debt/asset ratio of 63 percent. Thus, a debt/asset ratio of 75 percent is a conservative, yet reasonable, benchmark for failure of the operation.

The present value of the average maximum income generated during retirement and the probability of meeting estimated living needs during retirement are reported. These estimates measure the financial risk facing operators during retirement. For the probability of meeting estimated living needs, success is defined as generating a portfolio of farm and nonfarm assets which, when combined with estimated Social Security benefits, provides an annual stream of income greater than the estimated living needs during retirement.

The present value of the cumulative tax liability allows comparison of the tax savings generated by use of different investment strategies. The annual tax liabilities are discounted by the mean nominal rate of inflation for each replication.

The final measures reported by INFOSEXN are used to measure the liquidity and diversity of the simulated operation. INFOSEXN reports farm assets, liquid assets, taxable portfolio assets, and retirement assets as a percentage of total assets.

Controls on the Simulation Model

To avoid unrealistic situations during the simulation, three controls have been placed on the system of spreadsheets. These controls limit capital purchases, force liquidation of operations which are too highly leveraged, and limit farm investment over the last seven years of the planning horizon.

The first control prevents the operator from making capital purchases for natural capital replacement when the cash expense/cash receipt ratio exceeds 90 percent. This control basically restricts capital purchases during difficult economic times. The justification for this control is subjective; an operation where cash expenses are greater than 90 percent of farm cash receipts will not have much cash available for cash purchases. Further, the operator of such a firm will have difficulty obtaining a term loan for capital purchases.

The second control forces liquidation of the farm assets if the debt/asset ratio exceeds 75 percent. As discussed above, banks which make agricultural loans require an average of 37 percent equity from their potential clients. (Thurgood and LaDue) This equates to a debt/asset ratio of 63 percent. Thus, 75 percent is more lenient than the surveyed banks require. If the debt/asset ratio exceeds 75 percent, all farm assets are liquidated and all liabilities are dismissed. Nonfarm accounts are not directly affected by this control. For an operation that is liquidated, no future investment in the farm operation is allowed. The operator is assumed to obtain a nonfarm job at the same salary as his/her spouse. Thus, nonfarm income is doubled in the year the farm is liquidated. The user may alter this parameter to model a stricter or more lenient liquidation (foreclosure) policy.

The final control reflects an operator's desire to be debt-free during retirement. This control prevents investment in farm assets over the last seven years of the planning horizon. Thus, no new machinery is purchased, and no machinery or facilities are replaced. The user may alter this control if desired.

Description of LOANCALC

The LOANCALC file amortizes the operation's term debt. Specifically, this file determines the scheduled annual principal and interest payments, and calculates the remaining balance for each term loan. LOANCALC automatically accounts for pre-payment of principal by adjusting the remaining loan balance to reflect unscheduled principal payments.

All term debt is amortized using weighted average interest rates and weighted average terms (years). All term loans are assumed to be fixed-rate loans. That is, the interest rate for the term of the loan is the weighted average interest rate for the year in which the loan is obtained. To calculate these weighted averages, the user specifies the proportion of intermediate term debt to total term debt. This proportion is used as the weight in calculating the average interest rate and term for each year. For Cases I and II (owned assets, 50 percent debt/asset ratio, and owned assets, 65 percent debt/asset ratio) the proportion of intermediate debt to total term debt used in this study is 45 percent, and is assumed to remain constant throughout the planning horizon. The proportion of long-term debt to total term debt is 55 percent (1-0.45).

These proportions are estimated from balance sheet data for the US from 1960-1991 (Farm Business Balance Sheet, 1960-91). For Case III (Leasing) the proportion of intermediate debt to total term debt is 65 percent; thus, the proportion of long-term debt to total term debt is 35 percent (1-0.65). These proportions indicate the producer who leases a majority of his/her land will have relatively more intermediate debt than long-term debt.

The user also specifies the average term (in years) for intermediate debt and for long-term debt. The base scenario uses an average term of 7 years for intermediate debt and 15 years for long-term debt. These figures are from Thurgood and LaDue's survey of commercial banks which make agricultural loans. The authors report 82 percent of banks surveyed amortize real estate loans over a 15 to 20 year period, while 94 percent amortize intermediate term loans over a 5 to 7 year period (Thurgood and LaDue).

The weighted average interest rate used in amortizing each loan is calculated by multiplying the simulated intermediate and long-term interest rates by their respective weights (45 percent and 55 percent). The weighted average term of each loan is 11.4 years. This figure is calculated by multiplying the average term for intermediate and long-term loan by their respective weights (45 percent and 55 percent).

LOANCALC amortizes each loan through use of a standard annuity formula, separating the principal and interest portions of each annual payment. The annual principal and interest portions are exported to the cash flow generator in INFOSEXN. All unscheduled principal payments are treated in a "first-in, first-out" (FIFO) manner. Thus, unscheduled principal payments are applied to the most mature remaining term loan first. If the unscheduled payments retire the oldest loan, the remaining portion of the unscheduled payment is applied to the next most mature loan. Any unscheduled principal payments which are not used, due to retirement of all term debt, are transferred to the liquid asset account in the cash flow generator.

Description of TAXFORMS

TAXFORMS calculates the Federal tax liability for the producer. This spreadsheet is based on the Federal 1040 Tax form and tax regulations for 1993-94. (Hoffman, Smith, Willis; Research Institute of America (A); Research Institute of America (B); Davenport; Internal Revenue Service) All current tax regulations are assumed to remain constant throughout the planning horizon. The only modification made to the tax regulations is that all absolute dollar figures, such as tax bracket limits, standard deductions, maximum IRA, SEP, Keogh, 401(k) and 403(b) contributions, etc., are indexed to inflation each year. TAXFORMS is developed assuming the producer's business is organized as a sole proprietorship. This is a valid assumption as 87.7 percent of Virginia's farms and 86.7 percent of US farms are organized as sole proprietorships. (Womack) Corporations and partnerships are not considered in this study; however, minor modifications to the spreadsheet will allow the user to analyze these forms of business organization.

There are two main sections in TAXFORMS: the Self-Employment Tax worksheet (Schedule 1040-SE) and the US Individual Income Tax Form (Form 1040). The Self-Employment Tax worksheet determines the self-employment tax liability of the producer. Self-employment taxes are comprised of two components: social security tax and medicare tax. The current tax rates, 12.4 percent for social security and 2.9 percent for medicare, are assumed to remain constant throughout the planning horizon. The Self-Employment Tax worksheet automatically determines whether the producer must use the Short Schedule SE or the Long Schedule SE. Once this has been determined, the worksheet uses the gross nonfarm income and the net farm income calculated in INFOSEXN to determine the self-employment tax liability.

The US Individual Income Tax worksheet is a model of Form 1040. The taxpayer information (filing status, age, number of exemptions, etc.) and all income sources (net of 401(k)/403(b) contributions) are automatically transferred to the worksheet from INFOSEXN. INFOSEXN also transfers the annual contributions to SEP/Keogh accounts to this worksheet. The spreadsheet then determines the maximum allowable IRA deduction (automatically using either the short or long form of the IRA worksheet) and the amount of the standard deduction, thus calculating taxable income. From taxable income the spreadsheet calculates the income tax liability from tax rate schedules. The default settings for the tax rates are the current tax rates: 15 percent, 28 percent, 31 percent, 36 percent, and 39.6 percent. The user may change these rates in any year of the simulation.

Total Federal tax liability is calculated by adding the self-employment tax liability to the income tax liability. This figure is transferred back to the INFOSEXN cash flow generator, along with the maximum allowable IRA deduction.

Description of RETIRE

The RETIRE spreadsheet is used to analyze the financial position, liquidity, and probability of meeting estimated living needs of the operator and spouse during their retirement years. This spreadsheet bases its calculations on information imported from INFOSEXN, and exports its results to the summary section of INFOSEXN.

A major assumption in RETIRE is that all liabilities will be repaid at the retirement of the operator, primarily through sale of the farm assets. Retirement of the liabilities reflects the operator's desire to be debt-free during retirement. Nonfarm assets will be liquidated if the farm assets are insufficient to cover the liabilities. In liquidating farm and nonfarm assets, a deferred tax rate of 30 percent is assumed (Kohl; Thurgood and LaDue). This tax rate reflects taxes and fees owed on the sale of capital assets. Thus, to retire $700 of debt the operator must liquidate $1,000 of assets [$700/(1-.30)].

Ending asset accounts are adjusted to reflect the retirement of the liabilities. Asset accounts are decreased by the pre-tax amount necessary to repay the liabilities.

Ending liability accounts typically will be equal to zero, as all liabilities will have been repaid. However, in situations where total assets are not great enough to cover the liabilities and deferred taxes, there may be some liability accounts with positive ending balances. The ending net worth account balance is simply total adjusted assets minus total adjusted liabilities.

Living needs during retirement are difficult to estimate. Living expenses will depend on the wants and needs of each individual operator and spouse. The living needs will also depend on the rate of inflation over the planning horizon. In an attempt to generate realistic results, three level of estimated living needs are utilized in this study. The three levels are equivalent to $30,000, $60,000, and $90,000 in 1995 dollars. At retirement age, these levels will be different for each replication due to varying mean inflation rates among replications. To account for this, each level is compounded for 30 years at the mean inflation rate for each individual replication. Success in meeting these estimated living needs during retirement is defined as generating an annual stream of income greater than the estimated living needs for each replication.

Annual income generated during the retirement years is derived from three main sources: 1) income from the farm assets, 2) Social Security benefits, and 3) earnings from ending net worth (excluding farm assets). Income from farm assets may come in two different forms: sale of the farm assets or rental of the farm assets to another operator. To bypass the tax impacts of sale or transfer of the farm assets in retirement, this study assumes the remaining farm assets are rented to another farm operator. The annual rental income derived from this arrangement is assumed to be 3 percent of the value of total farm assets (Kohl). The rental payment is assumed to be adjusted each year for inflation. A further assumption is that the renter will maintain the farm assets at their current value; thus, the farm asset accounts do not decrease during retirement. This is a common rental practice in Virginia. The user may change this parameter to model other rental arrangements.

The second source of income during retirement is Social Security benefits. In reality these benefits are based on a person's average salary and the number of years he/she has been in the workforce (Social Security Administration). This is complicated for agricultural operators in that annual earnings typically are not constant. Thus, because agricultural operators face wide variation in annual earnings they may pay less Social Security taxes than a salaried employee. Further complicating this issue is the debate as to whether Social Security will actually exist in the future. To estimate the Social Security benefits received, this study assumes that the benefits cover three levels of the operator's living needs: 30 percent, 10 percent, and 0 percent of estimated annual living needs. The 30 percent level is determined from approximate annual Social Security benefits as a percent of average annual salary for a 65-year old operator and spouse earning approximately $57,600 (the maximum amount eligible for Social Security benefits). The annual benefit in this case is 35.8 percent of annual earnings. The approximate annual benefit for an operator (and spouse) who is 45 years old in 1994 and earns $57,600 is 43.8 percent. Thus, 30 percent is a conservative estimate. This parameter may be changed by the user to reflect different scenarios related to Social Security.

The third source of annual income during retirement is earnings on the operator's nonfarm assets. This study assumes the net worth (excluding farm assets) of the operator is used to purchase an immediate annuity to provide a steady stream of income during retirement. The annual stream of income generated by the annuity is determined using a constant growth annuity formula (See Appendix B). This formula assumes the annual income stream grows each year at the mean rate of inflation for each individual replication. The rate of return for the annuity is assumed to be the mean rate of return for the conservative (beta = 0.5) asset account for each individual replication.

Total annual income generated during retirement is equal to rental income from the farm assets, Social Security benefits, and income from the immediate annuity. The probability of success in meeting living needs during retirement is calculated by counting the number of replications where total annual income during retirement is greater than the estimated annual living needs during retirement. As there are 100 replications, the total number of successes represents the probability of success.

RETIRE also determines the percentage of living needs covered by the total annual income stream generated during retirement. This measure is simply total annual income generated divided by estimated living needs during retirement. This measure complements the probability of success in meeting estimated living needs by providing an estimate of the ability of the operator to meet living needs during retirement rather than simply indicating if the operator will be able to meet his/her living needs during retirement.

Description of ESTRATES

ESTRATES (Estimated Rates) contains the vectors of 8 stochastic rates of return and interest rates for a 30-year period. In order to run 100 replications, there are 100 vectors for each of the stochastic rates in ESTRATES. The same 100 vectors for each stochastic rate are used for each scenario to reduce the chance of random effects occurring between scenarios. Table 3.1 lists the rates which are simulated in this study. These simulated rates are imported into the cash flow generator in INFOSEXN.

Chapter 4

Results

"Some days you win. Some days you lose.
Some days it rains." Crash Davis

This chapter presents the results from the analytical model. The impact of the various scenarios on mean ending farm assets, total assets, and net worth, probability of meeting living needs during retirement, probability of farm failure, diversity of the producer's portfolio at retirement, mean discounted tax liability and breakeven tax rate between retirement investments is examined. The results for each capitalization case (Case I, II, and III) are discussed individually. Following the discussion of each case is a brief comparison of results across the three cases. To aid in the discussion of the results, the following terminology is used:

NONE - the retirement category where no retirement investment vehicles are used
IRA - the retirement category where the producer and spouse make tax-deductible contributions to IRAs
SEP - the retirement category where the producer utilizes a SEP along with IRAs for the producer and spouse
ALL - the retirement category where the producer utilizes IRAs, a SEP, and spousal 401(k) plan
Investment Strategy - refers to whether the producer uses conservative, balanced, aggressive, or dynamic investment strategy
Cash Preference - refers to the use of the cash margin for reinvestment in the farm versus prepaying term debt
Case I - the capitalization case where the operation has a beginning debt/asset ratio of 50 percent
Case II - the capitalization case where the operation has a beginning debt/asset ratio of 65 percent
Case III - the capitalization case where the operation has a beginning debt/asset ratio of 65 percent and leases a majority of the land

Thirty-two scenarios are simulated and analyzed, with each scenario differing with respect to retirement category, investment strategy, and cash preference. Statistical analyses are performed on the means for ending farm assets, total assets, net worth, and discounted tax liability for each scenario. Figure 4.1 illustrates the basic nature of the statistical analyses. The means of the above variables are compared using four defined tests. Test A compares the means across retirement category regardless of investment strategy and cash preference. This is a comparison of the column means. Test B compares the means across investment strategy and cash preference, regardless of retirement category. Test B is a comparison of the row means. Test C is a comparison of means across retirement category, given a particular investment strategy and cash preference. In essence, this method is a comparison between the cells of the matrix for a particular row. For example, this test is used to compare the means for NONE, IRA, SEP, and ALL, given the producer is conservative and primarily reinvests the cash margin in the farm. Test D compares the means across investment strategy and cash preference, given the retirement category. This is a comparison between the cells of the matrix for a particular column.

Analysis of variance (ANOVA) is used to conduct the four tests described above. Analysis of variance, which allows multiple comparison of means, indicates if significant differences exists between these means; however, it does not identify which means are greater or less than other means. When ANOVA indicates significant differences between the means, Bonferroni t-tests are conducted to identify the relationship between means. For example, Bonferroni pairwise t-tests indicate whether mean x is greater than mean y. For the analysis which follows, ANOVA and the Bonferroni t-tests are conducted at an overall level of significance of 0.05.

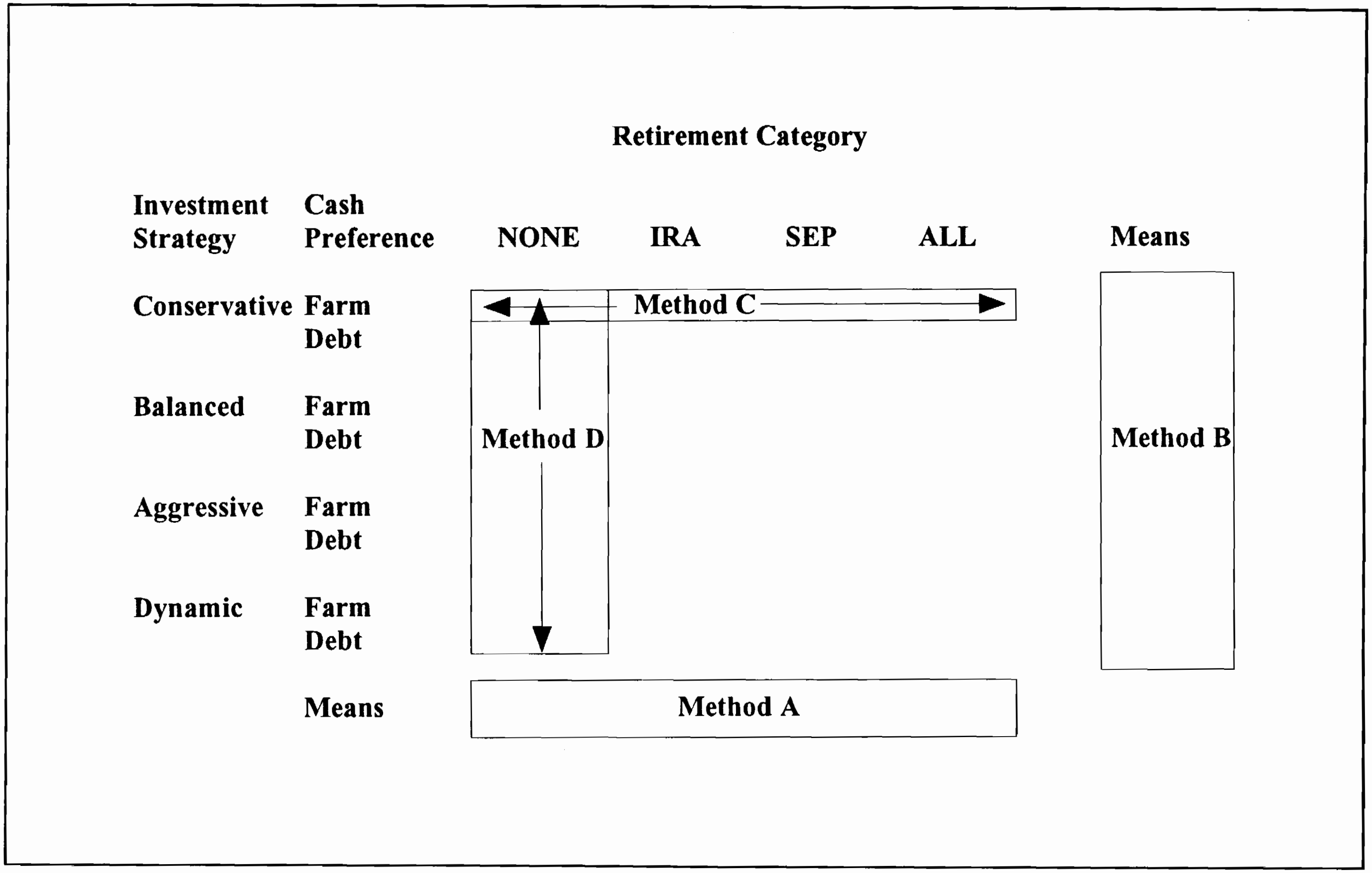

Figure 4.1 Schematic of Statistical Analyses

Case I: 50 Percent Debt/Asset Ratio

Mean Ending Farm Assets

The mean ending farm assets for each scenario are summarized in Table 4.1. An analysis of variance (ANOVA) of the mean ending farm asset value across all retirement categories, regardless of cash preference or investment strategy (Test A), indicates there is no significant difference ($p = 0.99$). The same result is found when comparing mean ending farm assets for each investment strategy and cash preference, regardless of retirement category (Test B). Thus, there is no difference between mean ending farm assets for the four investment strategies and the two cash preferences at the 0.05 level. Similarly, there is no difference between mean ending farm assets across retirement categories, given risk and cash preference (Test C), or across risk and cash preference, given retirement category (Test D).

The results indicate investment in IRAs, SEPs, and 401(k) plans does not have a major impact on the size or growth of the farm in terms of total farm assets.

Table 4.1 Mean Ending Farm Assets for Case I.

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL	Means
Conservative	Farm	$9,118,718	$9,079,941	$8,796,018	$8,630,983	$8,906,415
	Debt	$8,466,649	$8,435,052	$8,329,773	$8,237,880	$8,367,339
Balanced	Farm	$9,125,540	$9,086,789	$8,801,076	$8,709,830	$8,930,809
	Debt	$8,468,292	$8,436,762	$8,331,094	$8,313,012	$8,387,290
Aggressive	Farm	$9,132,325	$9,170,216	$8,882,735	$8,714,531	$8,974,952
	Debt	$8,469,908	$8,515,051	$8,408,997	$8,314,201	$8,427,039
Dynamic	Farm	$9,135,539	$9,138,128	$8,849,897	$8,716,475	$8,960,010
	Debt	$8,471,221	$8,481,047	$8,374,684	$8,315,065	$8,410,504
	Means	$8,798,524	$8,792,873	$8,596,784	$8,493,997	$8,670,545

Further, investment strategy of the producer and cash preference have relatively little impact on ending farm assets. Thus, there is no significant impact on ending farm asset value due to prepaying term debt instead of reinvesting in the farm.

Mean Ending Total Assets

Mean ending total assets are significantly impacted by different retirement categories, investment strategies, and cash preferences (See Table 4.2). There is a highly significant difference in mean ending total asset values across retirement categories, regardless of investment strategy or cash preference (Test A) ($p < 0.0001$). ALL provides the highest ending total asset value of the retirement categories. SEP provides the next highest ending value, followed by IRA and NONE. The Bonferroni t-tests indicate there is a difference between the mean ending total asset value for each of the retirement categories. This indicates use of additional retirement investment vehicles tends to increase the mean total asset value at the end of the planning period. For example, mean ending total assets for ALL are 155 percent greater than for

Table 4.2 Mean Ending Total Assets for Case I.

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL	Means
Conservative	Farm	$9,744,002	$10,134,718	$11,713,369	$12,965,535	$11,139,406
	Debt	$9,304,107	$9,694,138	$11,335,172	$12,631,341	$10,741,190
Balanced	Farm	$10,440,017	$12,699,318	$18,341,698	$24,145,416	$16,406,612
	Debt	$10,003,050	$12,247,066	$17,913,988	$23,771,464	$15,983,892
Aggressive	Farm	$11,140,794	$15,340,956	$25,046,757	$35,255,253	$21,695,940
	Debt	$10,703,739	$14,875,561	$24,568,760	$34,840,965	$21,247,256
Dynamic	Farm	$10,799,684	$14,779,584	$23,767,081	$33,442,244	$20,697,148
	Debt	$10,367,231	$14,317,749	$23,295,422	$33,031,616	$20,253,005
	Means	$10,312,828	$13,011,136	$19,497,781	$26,260,479	$17,270,556

NONE, and 102 percent greater than for IRA. Thus, use of all retirement vehicles [IRAs, SEPs, and 401(k)s] generates more than 1.5 times as much total assets by the end of the planning period as the use of no retirement vehicles.

The mean ending total asset values for each investment strategy and cash preference, regardless of the retirement category (Test B), are also significantly different. Means for the dynamic and aggressive investment strategies are not significantly different from each other, but they are 26-32 percent greater than the mean ending total asset values for the balanced and 86-95 percent greater than the mean ending total assets for conservative producers. The balanced attitude generates a 47 percent greater mean ending total asset value than the conservative attitude. There is no difference between the mean ending total asset values for the cash preference within each investment strategy (Test B). That is, given the investment strategy, there is no difference in ending total assets due to prepaying debt instead of reinvesting in the farm.

For conservative producers, there is no difference between ALL and SEP (Test C), which provide the highest mean ending total asset values. Bonferroni t-tests indicate there is no difference between SEP and IRA; however, there is a significant difference between IRA and ALL. Use of all retirement plans tends to generate 33-36 percent more ending total assets than use of no retirement plans. Similarly, there is no difference between the mean total assets for IRA and NONE, although there is a significant difference between the means for NONE and SEP. Thus, there is some degree of intransitivity between the mean total assets between retirement categories.

The mean total assets for producers with balanced, aggressive, and dynamic investment strategies are also different across retirement categories (Test C). ALL generates the largest mean total assets, over 200 percent greater than the mean total assets for NONE for producers with aggressive and/or dynamic investment strategies. SEP generates the next highest mean ending total asset values, more than twice the values for NONE for aggressive and/or dynamic producers. IRA and NONE generate the lowest mean total assets; there is no difference in mean total assets between IRA and NONE. This is due to the phase-out of tax-deductible IRA contributions for producers who earn high levels of income. Married producers filing joint returns who earn more than $50,000 can make no tax-deductible contributions to their IRAs.

Mean total assets are not significantly affected by investment strategy or cash preference, given the producer uses no retirement vehicles (Test D) ($p = 0.22$). However, when any retirement vehicles (IRA and SEP) are used there are differences in mean total assets due to investment strategy and cash preference ($p < 0.0001$). Assuming the producer has IRAs and/or SEPs, the aggressive and dynamic investment strategies generate the highest mean total asset values. These attitudes and cash preferences generate ending total assets 45-114 percent greater than conservative attitudes. Again, there is some degree of intransitivity present in the results. However, in general, the aggressive and dynamic investment strategies generate the highest mean ending total assets, followed by the balanced investment strategies. The conservative attitudes generate the lowest mean ending total assets.

Similar results are found when all retirement vehicles are utilized (Test D). The aggressive and dynamic attitudes provide the highest mean ending total asset value, 150 percent greater than the conservative attitudes. The next highest mean total asset value is generated by the balanced investment strategies, followed by the conservative investment strategies. In this retirement category there is no difference in mean total assets due to the cash preference. That is, using the cash margin mainly for reinvestment in the farm provides approximately the same mean total assets as using the cash margin to prepay debt.

To summarize the results dealing with mean ending total asset value, use of retirement vehicles has a significant impact on the ending total assets for the producer. As farm assets are not impacted by investment in retirement vehicles, the increase in total assets comes directly from capital invested in the IRAs, SEPs, and/or 401(k) plans.

Mean Ending Net Worth

The results for mean ending net worth are very similar to the results for the mean ending total assets (Table 4.3). With the exception of some minor intransitivity between investment strategies and cash preferences, the results indicate the use of retirement vehicles increases the mean ending net worth of the producer. The use of all retirement vehicles provides the highest mean ending net worth, regardless of investment strategy and cash preference (Test A). Mean ending net worth for ALL is 1.5 times greater than ending net worth for NONE. The results are similar given the specific investment strategy and cash preference (Test C) -- the use of retirement vehicles increases the mean ending net worth. Analysis of the mean ending net worth for different investment strategies and cash preferences, regardless of retirement category (Test B), indicates the aggressive and dynamic attitudes generate ending net worth 27-34 percent greater than the balanced investment strategies, and 92-102 percent greater than the conservative investment strategies. The balanced investment strategies generate ending net worth 51 percent greater than the conservative

Table 4.3 Mean Ending Net Worth for Case I.

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL	Means
Conservative	Farm	$9,112,317	$9,425,798	$10,938,265	$12,008,845	$10,371,306
	Debt	$8,887,033	$9,198,780	$10,758,551	$11,848,549	$10,173,228
Balanced	Farm	$9,813,171	$11,995,150	$17,570,547	$23,140,495	$15,629,841
	Debt	$9,584,421	$11,750,126	$17,335,992	$22,935,835	$15,401,594
Aggressive	Farm	$10,517,434	$14,599,788	$24,237,732	$34,252,242	$20,901,799
	Debt	$10,283,586	$14,336,676	$23,948,701	$34,003,562	$20,643,131
Dynamic	Farm	$10,179,940	$14,071,741	$22,990,750	$32,441,972	$19,921,101
	Debt	$9,950,152	$13,811,475	$22,708,316	$32,197,177	$19,666,780
	Means	$9,791,007	$12,398,692	$18,811,107	$25,353,585	$16,588,597

investment strategies. These results also hold true given the specific retirement category (Test D). In general, there is little advantage to using the cash margin to prepay debt as opposed to using it for reinvestment in the farm.

Probability of Meeting Family Living Expenses in Retirement

The probability of meeting estimated living needs during the retirement years is an indicator of an operator's success in accumulating an investment portfolio large enough to generate an annual income stream greater than estimated annual living needs. This measure is calculated by comparing the maximum annual income stream possible from the operator's portfolio at the end of the planning horizon to the level of estimated annual living needs. Success is defined as having a portfolio which generates an annual income stream greater than or equal to the estimated annual living needs.

Tables 4.4-4.6 show the probability of meeting estimated living needs for each cash preference and investment strategy for the case of an operator with a 50 percent debt/asset ratio, given different levels of estimated living needs and Social Security benefits. Table 4.4 summarizes the probability of meeting living needs for all investment strategies, investment strategies, and retirement categories for three levels of Social Security benefits, assuming annual living needs during retirement equivalent to $30,000 in 1995 dollars. This table illustrates the probability of meeting one's estimated living needs is quite high regardless of the cash preference, investment strategy, or the retirement investment vehicles used.

For producers who use none of the major retirement investment vehicles (NONE) the probability of meeting their living needs ranges from 0.95 to 0.97 depending on the producer's investment strategy (conservative, balanced, or aggressive) and cash preference (investment in farm versus prepayment of debt). The probability increases to 0.98-1.00 for IRA and SEP. When all retirement investment vehicles are used (ALL), the probability of meeting $30,000 in living needs is 1.00, indicating a

Table 4.4 Probability of Meeting Estimated Annual Family Living Expenses of $30,000 During Retirement for Case I.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	95	98	98	100
	Debt	96	99	99	100
Balanced	Farm	97	100	100	100
	Debt	97	100	100	100
Aggressive	Farm	97	100	100	100
	Debt	97	100	100	100
Dynamic	Farm	97	100	100	100
	Debt	97	100	100	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	95	97	97	100
	Debt	95	97	97	100
Balanced	Farm	96	100	100	100
	Debt	96	100	100	100
Aggressive	Farm	97	100	100	100
	Debt	97	100	100	100
Dynamic	Farm	96	100	100	100
	Debt	96	100	100	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	95	97	97	100
	Debt	95	97	97	100
Balanced	Farm	96	100	100	100
	Debt	96	100	100	100
Aggressive	Farm	97	100	100	100
	Debt	97	100	100	100
Dynamic	Farm	96	100	100	100
	Debt	96	100	100	100

sure event. Pairwise z-tests for differences among the scenarios indicate there are no significant differences [α = 0.0083 (overall α = 0.05)] in the probability of meeting living needs between any of the retirement categories (NONE, IRA, SEP, ALL) for all investment strategies.

There are no major differences in probabilities across the three levels of Social Security benefits. Thus, for a producer who expects relatively low living needs during retirement there is a high probability he/she will be able to meet his/her living needs regardless of the level of Social Security benefits.

Table 4.5 illustrates the probability of meeting living needs for a producer who requires the equivalent of $60,000 per year during retirement. As expected, the probability of meeting living needs decreases from the $30,000 scenario. However, when Social Security benefits provide 30 percent of living needs, there is very little difference from the $30,000 scenario. The main difference occurs within the IRA and SEP categories, where the probability decreases from 0.98 to 0.95 for the conservative attitudes. When Social Security provides 10 percent of living needs the probability of meeting living needs decreases further. However, there is little difference from the $30,000 scenario when Social Security provides 10 percent of living needs.

Relatively large changes occur in NONE when Social Security is assumed to provide 0 percent of living needs. The range of probability of meeting living needs decreases from 0.95-0.97 to 0.88-0.92 for the various investment strategies and investment strategies. However, there is relatively little change in the probabilities for IRA, SEP, and ALL.

For a producer who expects annual living needs equivalent to $90,000 (Table 4.6), the probability of meeting living needs drops significantly when no retirement investment vehicles are utilized. This is especially true when Social Security provides 0 percent of living needs; the probability of meeting living needs decreases to a range of 0.62 to 0.69. Thus, when Social Security is not available, approximately 1/3 of

Table 4.5 Probability of Meeting Estimated Annual Family Living Expenses of $60,000 During Retirement for Case I.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	IRA	SEP	ALL
			Retirement Category		
Conservative	Farm	95	95	95	99
	Debt	95	95	95	99
Balanced	Farm	96	99	99	100
	Debt	96	99	99	100
Aggressive	Farm	96	100	100	100
	Debt	96	100	100	100
Dynamic	Farm	96	100	100	100
	Debt	96	100	100	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	IRA	SEP	ALL
			Retirement Category		
Conservative	Farm	94	95	95	99
	Debt	92	95	95	99
Balanced	Farm	95	98	98	100
	Debt	93	98	98	100
Aggressive	Farm	95	100	100	100
	Debt	94	100	100	100
Dynamic	Farm	95	99	99	100
	Debt	93	99	99	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	IRA	SEP	ALL
			Retirement Category		
Conservative	Farm	88	95	95	98
	Debt	88	95	95	98
Balanced	Farm	91	98	98	100
	Debt	90	98	98	100
Aggressive	Farm	92	99	99	100
	Debt	90	99	99	100
Dynamic	Farm	89	99	99	100
	Debt	89	99	99	100

Table 4.6 Probability of Meeting Estimated Annual Family Living Expenses of $90,000 During Retirement for Case I.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	87	95	95	98
	Debt	85	95	95	98
Balanced	Farm	89	98	98	100
	Debt	88	98	98	100
Aggressive	Farm	90	99	99	100
	Debt	90	99	99	100
Dynamic	Farm	88	99	99	100
	Debt	87	99	99	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	71	89	91	96
	Debt	69	88	91	96
Balanced	Farm	74	97	97	100
	Debt	71	97	97	100
Aggressive	Farm	76	99	99	100
	Debt	72	99	99	100
Dynamic	Farm	73	99	99	100
	Debt	71	99	99	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	63	79	89	96
	Debt	62	76	89	96
Balanced	Farm	66	96	97	100
	Debt	65	95	97	100
Aggressive	Farm	69	99	99	100
	Debt	68	99	99	100
Dynamic	Farm	67	98	99	100
	Debt	65	97	99	100

producers who expect living needs equivalent to $90,000 during retirement will not be able to meet their living needs.

It is interesting to note that there is no significant difference between IRA and SEP as related to the probability of meeting living needs. The only situation where there is a significant difference between IRA and SEP is for a producer with a conservative investment strategy who expects living needs equivalent to $90,000 and there are no Social Security benefits available. The use of IRAs and a SEP typically generates a larger portfolio at the end of the planning horizon than use of only IRAs. However, a majority of the portfolios generated in IRA and SEP are sufficiently large to meet the level of estimated living needs. This explains the lack of significance in the difference in probabilities between IRA and SEP.

Further, there is relatively little difference in the probability of meeting living needs across investment strategies and investment strategies, given retirement strategy and the level of Social Security benefits. Results indicate producers with aggressiveinvestment strategies tend to have a higher probability of meeting living needs during retirement than conservative producers. However, the difference in probabilities between the investment strategies is relatively small. Similarly, there is little difference between investing in the farm versus prepaying debt in terms of the probability of meeting living needs.

Although there is no difference in the probability of meeting living needs due to investment strategy and cash preference, given retirement category, interesting results occur when the probabilities for all investment strategies and investment strategies within each retirement category are analyzed (column means of Table 4.4). Table 4.7 illustrates the probability of meeting living needs regardless of investment strategy and cash preference. Table 4.7 shows the probability of meeting living needs for differing levels of Social Security benefits and estimated living needs, given retirement strategy. When no retirement vehicles are utilized, the probability of meeting living needs ranges from 0.66 to 0.97, depending on the level of Social

Table 4.7 Probability of Meeting Estimated Family Living Expenses Given Social Security Benefits and/or Family Living Expenses, Regardless of Investment Strategy and Cash Preference (Case I).

Social Security Benefits	Family Living Expenses	NONE	Retirement Category IRA	SEP	ALL
30 %	$30,000	97	100	100	100
	$60,000	96	99	99	100
	$90,000	88	98	98	100
10%	$30,000	96	100	100	100
	$60,000	94	98	98	100
	$90,000	72	96	97	99
0%	$30,000	96	99	99	100
	$60,000	90	98	98	100
	$90,000	66	92	96	99

Security benefits and the estimated level of living needs. Given the level of Social Security benefits, the probability of meeting living needs decreases as the level of living needs increases. Pairwise z-tests indicate significant differences between all levels of living needs, given Social Security benefits, except between $30,000 and $60,000 when Social Security provides 30 percent of living needs.

Similar results are obtained for IRA and SEP. The probabilities of meeting living needs increase as compared to NONE, and the range of probabilities decreases significantly. For IRA, the range of probabilities is 0.92 to 0.99. For SEP, the range of probabilities is 0.96 to 0.99. The range of probabilities is even smaller for ALL (0.99 to 1.00). Thus, when all retirement vehicles are used the producer is almost certain to be able to meet living needs during retirement.

Pairwise z-tests between levels of Social Security benefits, given the level of living needs, indicate the level of Social Security benefits basically has no impact on the producer's ability to meet living needs during retirement when any or all of the retirement vehicles are utilized. However, when no retirement vehicles are used, the level of Social Security benefits is very important to producers with relatively high estimated living needs. For producers with living needs of $60,000 or $90,000, there is a very significant difference ($p < 0.01$) in the probability of meeting living needs due to Social Security. That is, as the level of Social Security benefits decreases, the producer's ability to meet living needs significantly decreases.

Table 4.7 also summarizes the producer's ability to meet living needs for different combinations of retirement vehicles and levels of Social Security benefits, given the estimated level of living needs. Clearly, given a level of Social Security benefits, the greater the use of retirement vehicles, the greater the probability of meeting living needs during retirement. This is especially true for producers with higher levels of living needs.

Again, it is interesting to note there is no significant difference between IRA and SEP, except at the $90,000 level of living needs when Social Security benefits are not available. This may be explained by the mean annual income stream possible during retirement as a percentage of living needs. Mean annual income is well above the three levels of living needs when IRAs and/or SEPs are utilized. For example, producers with a balanced investment strategy who use IRAs and SEPs have portfolios capable of generating an income stream 4.5 times larger than the estimated living needs of $90,000 without any Social Security benefits. A SEP combined with an IRA provides a higher mean annual income than an IRA by itself; however, both categories provide a mean annual income greater than the three levels of estimated living needs. Thus, the extra assets invested in a SEP have little impact on meeting lower levels of living needs.

In general, the above results indicate that use of retirement vehicles such as IRAs, SEPs, and 401(k)s can have a major impact on a producer's ability to meet living needs during retirement. These retirement vehicles become more important for higher levels of estimated living needs and for lower levels of expected Social Security benefits.

Farm Failures

Farm are considered to be failures in this study when the debt/asset ratio for the operation (including nonfarm assets) exceeds 75 percent. At this point, farm assets are liquidated and the operator is assumed to obtain a nonfarm job. Table 4.8 reports the number of replications ending with farm failures for an operation starting with a 50 percent debt/asset ratio at the beginning of the planning horizon. When no retirement plans are utilized, the base farm faces foreclosure 5 times out of 100 replications, regardless of investment strategy or cash preference.

The probability of failure decreases to 0.03 when operators with aggressive investment strategies utilize IRAs or IRAs in combination with a SEP. The decrease may be attributed to the fact the assets in the IRAs or SEP are great enough to keep

Table 4.8 Probability of Farm Failure for Case I.

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	5	5	5	5
	Debt	5	5	5	5
Balanced	Farm	5	5	5	3
	Debt	5	5	5	3
Aggressive	Farm	5	3	3	3
	Debt	5	3	3	3
Dynamic	Farm	5	4	4	3
	Debt	5	4	4	3

the operator's debt/asset ratio less than 75 percent. Similarly, when 401(k) plans are utilized, the number of farm failures is 3 for all but conservative producers.

The probability of farm failure is quite low in this capitalization case. This low probability may be explained by the fact the producer has a beginning equity of $500,000. The high equity position provides a buffer on which the producer can rely during difficult economic periods. Case II examines the situation where the producer has a lower beginning equity position.

Diversity of Producer's Portfolio

Table 4.9 lists the breakdown of the producer's portfolio at the end of the 30-year planning horizon. Assets are grouped under the following categories: Farm, Liquid, Taxable Portfolio, IRA, SEP, and 401(k). Of these categories, only the farm assets are relatively illiquid at the age of retirement. All other asset categories are very liquid at the time of the producer's retirement.

Table 4.9 shows the assets for a producer with no retirement vehicles are very highly concentrated in farm assets. The range is from 79 percent for aggressive producers to 94 percent for conservative producers. The remainder of the assets are either in a liquid account (3-6 percent) or invested in taxable assets such as mutual funds, stocks, or bonds (3-15 percent). This represents a very illiquid portfolio at the time of retirement. Such a portfolio may require producers to liquidate farm assets or rent the farm assets to obtain funds to meet living needs during retirement. As farm assets tend to be relatively illiquid, the producer may face cash flow problems until the farm assets are liquidated. Further, a portfolio with high concentration in farm assets may be very sensitive to agricultural economic conditions. A downturn in the industry may greatly decrease the value of the producer's portfolio at any point in time. This may have drastic effects on the producer's ability to meet living needs during retirement. The concentration of assets in the farm operation may also lead to significant problems in transferring the operation to the next generation.

Table 4.9 Percentage of Total Assets Invested in Various Asset Categories by Retirement Category, Investment Strategy, and Cash Preference (Case I).

Retirement Category	Investment Strategy	Cash Preference	Asset Category Farm	Liquid	Taxable	IRA	SEP	401(k)
NONE	Conservative	Farm	94%	3%	4%	0%	0%	0%
		Debt	91%	6%	3%	0%	0%	0%
	Balanced	Farm	87%	3%	10%	0%	0%	0%
		Debt	85%	6%	10%	0%	0%	0%
	Aggressive	Farm	82%	3%	15%	0%	0%	0%
		Debt	79%	5%	15%	0%	0%	0%
	Dynamic	Farm	85%	3%	13%	0%	0%	0%
		Debt	82%	6%	13%	0%	0%	0%
IRA	Conservative	Farm	90%	3%	3%	4%	0%	0%
		Debt	87%	5%	3%	5%	0%	0%
	Balanced	Farm	72%	2%	8%	18%	0%	0%
		Debt	69%	4%	8%	19%	0%	0%
	Aggressive	Farm	60%	2%	11%	27%	0%	0%
		Debt	57%	4%	11%	28%	0%	0%
	Dynamic	Farm	62%	2%	9%	27%	0%	0%
		Debt	59%	4%	9%	28%	0%	0%
SEP	Conservative	Farm	75%	2%	2%	4%	17%	0%
		Debt	73%	3%	2%	4%	17%	0%
	Balanced	Farm	48%	1%	4%	14%	33%	0%
		Debt	47%	2%	4%	14%	34%	0%
	Aggressive	Farm	35%	1%	5%	18%	41%	0%
		Debt	34%	1%	5%	19%	41%	0%
	Dynamic	Farm	37%	1%	4%	18%	39%	0%
		Debt	36%	2%	4%	19%	40%	0%
ALL	Conservative	Farm	67%	1%	2%	4%	15%	12%
		Debt	65%	2%	1%	4%	15%	12%
	Balanced	Farm	36%	1%	2%	12%	24%	25%
		Debt	35%	1%	2%	12%	25%	25%
	Aggressive	Farm	25%	0%	3%	14%	28%	30%
		Debt	24%	1%	3%	14%	28%	30%
	Dynamic	Farm	26%	0%	2%	14%	27%	29%
		Debt	25%	1%	2%	14%	27%	30%

Use of IRAs enhances the diversification of the producer's portfolio, especially for less conservative producers. Portfolios for conservative producers who use IRAs are still heavily concentrated in farm assets, with 90 percent of total assets invested in farm assets. Again, these producers have an illiquid portfolio at the time of retirement.

Less conservative producers have 18-28 percent of their portfolios invested in IRAs, with 57-72 percent invested in farm assets. These producers have portfolios which are much more liquid and more diversified than the conservative producers. The balanced and aggressive producers are less likely to face cash flow problems when they retire. Their portfolios are much more diversified than the conservative producers; thus, they tend to face less total risk if the agricultural industry experiences difficult economic times.

The use of SEPs has a dramatic impact on the diversity of the producer's portfolio. Conservative producers have, on average, 17 percent of their assets in a SEP, and 75 percent of their assets in the farm. IRAs represent 4 percent of these producer's assets. While still heavily concentrated in farm assets, conservative producers with SEPs are in a much more liquid position at age of retirement than conservative producers without SEPs.

Producers with balanced investment strategies tend to have the same amount of assets invested in the farm as they have in IRAs and SEPs. These producers have 47-48 percent invested in farm assets, while having 14 percent in IRAs and 33-34 percent in a SEP. Thus, the assets for these producers are evenly divided between farm assets and retirement vehicles.

Aggressive producers with SEPs actually have more assets in their SEPs (41 percent) than they have invested in farm assets (35 percent). These producers have approximately 19 percent of their assets in an IRAs at age 65. Clearly, the aggressive producers are able to attain a strong liquidity position at the age of retirement through diversification of their portfolios.

Producers who take advantage of IRAs, SEPs, and 401(k) plans are even more liquid and diversified. Conservative producers using all of the retirement plans have approximately two-thirds of their assets invested in the farm. The remaining one-third is invested in the SEP and 401(k) plan.

Balanced and aggressive producers have less than 40 percent of their assets invested in the farm. These producers are very well diversified. For example, the balanced producers have 35 percent of total assets invested in the farm, 25 percent invested in a SEP, 25 percent in a 401(k), and 12 percent in IRAs.

Comparing the percentage of the portfolio invested in farm assets across retirement plans, there are significant differences between all retirement plans. The only exceptions are between NONE and IRA for conservative producers ($p > 0.15$), and between SEP and ALL for all investment strategies ($p > 0.05$). Thus, use of IRAs and SEPs does have a significant impact on the percentage of assets invested in the farm, while the use of a 401(k) has relatively little impact on farm assets.

There are no significant differences in the percentage of assets in the liquid account and the taxable account across retirement plans. The liquid account tends to remain between 1 and 6 percent of total assets, while the taxable account ranges from 1-3 percent for conservative producers to 2-15 percent for aggressive producers.

The difference in the percentage of total assets invested in IRAs is not significant between IRA and SEP ($p > 0.05$) or SEP and ALL ($p > 0.21$). Thus, the amount of total assets in IRAs does not significantly change when a SEP or 401(k) plan is added to the producer's portfolio. Again, the percentage of total assets invested in IRAS remains a constant 4 percent for conservative producers and ranges from 14-28 percent for aggressive and dynamic producers.

The change in the proportion of total assets invested in a SEP is not significant for conservative and balanced producers when the SEP and ALL categories are compared ($p > 0.08$). However, the difference in the proportion invested in a SEP for aggressive and dynamic producers is significant at the 0.05 level.

The above results indicate the importance of retirement vehicles in providing liquid and diversified portfolios at the age of retirement. Producers who use any or all of these retirement vehicles are less likely to face cash flow problems when they retire from the farming operation. Also, they are less likely to lose a large portion of their portfolios if agriculture faces an economic downturn. With investments outside of agriculture, the well-diversified portfolios should be much less sensitive to economic conditions.

Mean Discounted Cumulative Tax Liability

Comparing the mean discounted cumulative tax liability for the planning horizon provides a measure of the tax implications of each of the 32 scenarios Table 4.10). For Case I there are significant differences in the tax liabilities across retirement categories, regardless of investment strategy and cash preference (Test A) (p < 0.0001). Bonferroni t-tests indicate there is no difference between the tax liability for NONE and IRA. These two retirement categories have the highest tax liability of

Table 4.10 Mean Discounted Cumulative Tax Liabilities for Case I.

Investment Attitude	Cash Preference	NONE	Retirement Category IRA	SEP	ALL	Means
Conservative	Farm	$622,427	$610,802	$510,830	$458,177	$550,559
	Debt	$615,503	$604,043	$508,707	$456,124	$546,094
Balanced	Farm	$633,296	$621,635	$518,199	$463,061	$559,048
	Debt	$625,713	$614,050	$515,469	$460,529	$553,940
Aggressive	Farm	$644,115	$630,726	$523,948	$469,535	$567,081
	Debt	$636,085	$622,572	$520,707	$466,643	$561,502
Dynamic	Farm	$646,494	$633,846	$526,485	$471,068	$569,473
	Debt	$638,083	$625,329	$523,035	$467,970	$563,604
	Means	$632,715	$620,375	$518,423	$464,138	$558,913

the retirement categories. The next highest tax liability is generated by SEP. ALL provides the lowest tax liability of all the retirement categories, approximately 27 percent lower than the tax liability for NONE. Results indicate the use of IRAs has a relatively small impact on the cumulative tax liability of the producer; however, use of SEPs and 401(k) plans tends to significantly reduce the tax liability of the producer.

The investment strategy of the producer and the cash preference have no impact on the tax liability of the producer. Comparison of mean present value of the cumulative tax liability across investment strategies and cash preferences, regardless of retirement category (Test B), shows no statistical difference.

Given a specific investment strategy and cash preference, there are differences in tax liability across retirement categories (Test C). For each investment strategy and cash preference there are no differences between NONE, IRA, and SEP. These retirement categories have the highest tax liability. Bonferroni t-tests indicate there is no difference between mean tax liability for SEP and ALL. Thus, some intransitivity present in the rankings of mean tax liability, but this intransitivity remains constant for all investment strategies and cash preferences. The results indicate that, given a specific investment strategy and cash preference, there is basically no impact in tax liability by use of IRAs. However, a producer who uses no retirement vehicles can significantly reduce his/her tax liability by use of a combination of IRAs, SEPs and/or 401(k) plans.

Given a specific retirement category, the producer will not reduce tax liability through use of different cash preferences or by changing his/her investment strategy (Test D). ANOVA procedures testing for differences in mean tax liability across investment strategies and cash preferences, given retirement category, produces p-values in excess of 0.99, indicating there is basically no probability that the means across each investment strategy and cash preference are different.

Breakeven Tax Rate at Retirement

Changes in the marginal tax rate may have impacts on the wealth accumulation associated with retirement investments. Tauer states the advantage of tax-deferred investments is negated if marginal income tax rates increase by 10 percentage points at age of retirement. However, Tauer's study occurred during a period when agricultural producers benefited from investment tax credits and capital gains taxes, and higher marginal tax rates.

A breakeven tax rate is calculated to determine the impact of increased marginal tax rates on the advantage of tax-deferred retirement investments. This breakeven tax rate represents the tax rate at which there is no advantage to tax-deferred retirement investment vehicles, as compared to non-tax-deferred investments; that is, the tax rate where the annual income stream from tax-deferred investments is equal to the annual income stream for non-tax-deferred investments. In essence, the breakeven tax rate is the total tax rate on the retirement accounts needed to equilibrate the ending net worth for each specific retirement category with the ending net worth for NONE. The breakeven tax rate is calculated assuming the current marginal tax rates (15, 28, 31, 36, and 39.6 percent of taxable income) remain static for the next 30 years.

The breakeven average tax rate is calculated by dividing the net difference in non-retirement accounts (liquid account, taxable account, and farm assets) between NONE and IRA, SEP, and ALL by the total value of the retirement accounts. For example, a producer with no retirement plans (NONE) has $275,000 in a liquid account, $350,000 in a taxable portfolio, and farm assets worth $8,200,000. A producer who uses IRAs (IRA) has $270,000 in a liquid account, $340,000 in a taxable portfolio, farm assets totalling $8,100,000 and $450,000 in an IRA. The breakeven tax rate is calculated as follows:

$$\text{Breakeven Tax Rate} = 1 - \frac{[(\$275m-\$270m) + (\$8.2mm-\$8.1mm) + (\$350m-\$340m)]}{\$450,000}$$

$$= 0.745$$

Thus, an average tax rate of 74.5 percent at the age of retirement negates the advantage of the IRA. The breakeven tax rate is applicable for lump-sum distributions of retirement funds and for annuitized withdrawal of retirement funds. A deferred tax rate of zero percent is assumed for the farm assets and taxable accounts. Using a deferred tax rate greater than zero results in higher breakeven tax rates. Thus, calculating breakeven tax rates assuming a zero percent deferred tax rate provides a more conservative estimate. The resulting breakeven tax rates for each retirement category are listed in Table 4.11 for every investment strategy and cash preference. An average tax rate of just over 62 percent equilibrates the ending net worth for NONE and IRA for conservative producers. This rate indicates that taxes can erode 62 percent of the retirement account before the advantage to investing in IRAs is lost. The breakeven rate increases to 71-73 percent when SEPs are used along with IRAs. Interestingly, the breakeven tax rate between NONE and ALL decreases slightly to 69-71 percent for the conservative producers. This is because the total retirement accounts increase by a smaller percentage than the non-retirement accounts decrease for this scenario; operations (with conservative producers) using all of the retirement plans tend to have much less capital in farm assets, the liquid account, and the taxable account than operations with no retirement plans.

The breakeven tax rate for the balanced producers ranges from 90 percent when all retirement plans are used to 93 percent when only IRAs are utilized. The

Table 4.11 Breakeven Tax Rate at Time of Retirement between NONE and IRA, SEP, and ALL for Case I.

Investment Strategy	Cash Preference	Retirement Category IRA	SEP	All
Conservative	Farm	63%	71%	69%
	Debt	63%	74%	71%
Balanced	Farm	93%	90%	90%
	Debt	93%	90%	90%
Aggressive	Farm	97%	93%	93%
	Debt	96%	93%	93%
Dynamic	Farm	97%	93%	93%
	Debt	96%	93%	93%

breakeven tax rate decreases slightly as more retirement plans are incorporated into the producer's portfolio. This is due to the shift in the distribution of assets from the non-retirement accounts to the retirement accounts.

Similar results are obtained for the aggressive and dynamic producers. The range of breakeven tax rates for these producers is 93-97 percent. This indicates the federal tax policy must take over 90 percent of the retirement accounts before the advantage of tax-deferred investing is lost. It is highly unlikely the federal tax rate will increase to 90 percent; therefore, it is typically advisable to take advantage of tax-deferred investments for retirement planning.

Case II: 65 Percent Debt/Asset Ratio

Mean Ending Farm Assets

As in Case I, mean ending farm asset value is not significantly affected by retirement investments, investment strategy, or cash preference (Table 4.12). ANOVA results indicate there is no statistical difference in mean ending farm asset value across retirement categories, regardless of cash preference or investment strategy (Test A) (p = 1.00). Mean ending farm assets for each investment strategy and cash preference, regardless of retirement category (Test B), are not significantly different at the 0.05 level. Similarly, there is no difference between mean ending farm assets across retirement categories, given risk and cash preference (Test C), or across risk and cash preference, given retirement category (Test D).

Results indicate investment in retirement plans does not have a major impact on the size or growth of the farm in terms of total farm assets. The size and growth of

Table 4.12 Mean Ending Farm Assets for Case II.

Investment Attitude	Cash Preference	NONE	Retirement Category IRA	SEP	ALL	Means
Conservative	Farm	$7,916,712	$7,885,895	$7,665,586	$7,548,550	$7,754,186
	Debt	$7,496,301	$7,470,489	$7,388,241	$7,321,029	$7,419,015
Balanced	Farm	$7,919,880	$7,987,316	$7,765,814	$7,799,613	$7,868,156
	Debt	$7,497,058	$7,569,473	$7,486,953	$7,570,735	$7,531,055
Aggressive	Farm	$7,923,000	$8,098,548	$7,923,444	$7,857,435	$7,950,607
	Debt	$7,497,808	$7,677,849	$7,642,941	$7,627,198	$7,611,449
Dynamic	Farm	$7,925,209	$8,100,759	$7,924,991	$7,858,603	$7,952,391
	Debt	$7,498,695	$7,678,740	$7,643,561	$7,627,708	$7,612,176
	Means	$7,709,333	$7,808,634	$7,680,191	$7,651,359	$7,712,379

the farm is not significantly reduced by investing in IRAs, SEPs, or 401(k) plans. Further, investment strategy of the producer and cash preference have relatively little impact on ending farm assets. There is no significant impact on mean ending farm asset value due to prepaying term debt instead of reinvesting in the farm.

Mean Ending Total Assets

Mean ending total asset values differ across retirement categories, investment strategies, and cash preferences (Table 4.13). The difference across retirement categories, regardless of investment strategy and cash preference (Test A), in mean ending total assets is highly significant ($p < 0.0001$). As in Case I, ALL generates the highest ending total asset value of the retirement categories, 171 percent larger than the ending total assets for NONE. SEP provides the next highest ending value, followed by IRA and NONE. Bonferroni t-tests indicate there is a significant difference between the mean ending total asset value for each of the retirement

Table 4.13 Mean Ending Total Assets for Case II.

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL	Means
Conservative	Farm	$8,406,527	$8,809,366	$10,059,441	$11,515,725	$9,697,765
	Debt	$8,132,762	$8,526,259	$9,836,738	$11,316,958	$9,453,179
Balanced	Farm	$8,955,902	$11,279,900	$15,527,473	$22,090,778	$14,463,513
	Debt	$8,650,786	$10,874,956	$15,170,338	$21,817,858	$14,128,485
Aggressive	Farm	$9,508,395	$13,747,769	$21,070,121	$32,424,543	$19,187,707
	Debt	$9,170,365	$13,240,529	$20,594,138	$32,081,467	$18,771,625
Dynamic	Farm	$9,253,633	$13,325,417	$20,166,333	$30,837,641	$18,395,756
	Debt	$8,921,163	$12,824,694	$19,697,227	$30,498,997	$17,985,520
	Means	$8,874,942	$11,578,611	$16,515,226	$24,072,996	$15,260,444

categories. This indicates the use of additional retirement investment vehicles tends to increase the mean total asset value at the end of the planning period.

Mean ending total asset values for each investment strategy and cash preference, regardless of the retirement category (Test B), are also significantly different. The mean ending total asset values for the dynamic and aggressive investment strategies generate the largest mean ending total assets, 90-98 percent larger than the conservative attitude. The dynamic and aggressive investment strategies are not significantly different from each other, but they are greater than the mean ending total asset values for the balanced and conservative producers. The balanced attitude generates a mean ending total asset value 47 percent greater than the conservative attitude. Again, using the cash margin for prepayment of debt generates a mean ending total asset value not significantly different than using the cash margin for reinvestment in the farm.

For conservative producers (Test C), ALL and SEP provide the highest mean ending total asset values, 20-39 percent larger than NONE. There is no difference in the mean between ALL and SEP. Bonferroni t-tests indicate there is no difference between SEP, IRA, and NONE; however, there is a significant difference between ALL and SEP, IRA and NONE. Again, there is some degree of intransitivity between the mean total assets between retirement categories.

The mean total assets for producers with balanced, aggressive, and dynamic investment strategies differ across retirement categories (Test C) in a similar manner as in Case I. ALL generates the largest mean total assets, 233-250 percent larger than the mean for NONE. SEP generates the next highest mean ending total asset value, 118-125 percent greater than the mean for NONE. IRA and NONE generate the lowest mean total assets; there is no difference between mean total assets for IRA and NONE.

Mean total assets are not significantly affected by investment strategy or cash preference in NONE (Test D) ($p = 0.65$). However, there are differences in mean total assets in IRA, SEP, and ALL due to investment strategy and cash preference ($p < 0.0001$). For a producer with IRAs and/or SEPs, the aggressive and dynamic investment strategies generate the highest mean total asset values, 51-109 percent greater than for NONE. Again, there is some degree of intransitivity present in the means. However, in general, the aggressive and dynamic investment strategies generate the highest mean ending total assets, followed by the balanced investment strategies. The conservative attitudes generate the lowest mean ending total assets.

The results are similar when all retirement vehicles are utilized. The aggressive and dynamic attitudes provide the highest mean ending total asset value, 168-182 percent greater than the mean for NONE. The next highest mean total asset value is generated by the balanced investment strategies, followed by the conservative investment strategies. In this retirement category using the cash margin mainly for reinvestment in the farm provides approximately the same mean ending total assets as using the cash margin to prepay debt.

Mean Ending Net Worth

The results for mean ending net worth are very similar to the results for the mean ending total assets, as in Case I (Table 4.14). The results indicate the use of retirement vehicles increases the mean ending net worth of the producer. The use of a combination of IRAs, SEPs, and 401(k)s provides the highest mean ending net worth, regardless of investment strategy and cash preference (Test A). The mean ending net worth for ALL is nearly 1.8 times larger than the mean for NONE. Similar results are obtained given the specific investment strategy and cash preference (Test C) -- the use of retirement vehicles increases the mean ending net worth. Analysis of the mean ending net worth for different investment strategies and cash preferences, regardless of retirement category (Test B), indicates the aggressive and dynamic attitudes generate mean ending net worths 29-35 percent greater than the balanced investment strategies, and 97-106 percent greater than the mean for the conservative attitude. The balanced

Table 4.14 Mean Ending Net Worth for Case II.

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL	Means
Conservative	Farm	$7,642,351	$7,952,327	$9,134,208	$10,391,462	$8,780,087
	Debt	$7,535,847	$7,836,961	$9,057,869	$10,316,312	$8,686,747
Balanced	Farm	$8,193,014	$10,321,864	$14,501,256	$20,731,978	$13,437,028
	Debt	$8,052,041	$10,081,435	$14,287,314	$20,578,438	$13,249,807
Aggressive	Farm	$8,746,578	$12,710,367	$19,951,098	$31,021,795	$18,107,460
	Debt	$8,569,921	$12,364,695	$19,616,018	$30,797,142	$17,836,944
Dynamic	Farm	$8,495,282	$12,291,397	$19,049,715	$29,437,173	$17,318,392
	Debt	$8,323,635	$11,951,745	$18,721,900	$29,217,277	$17,053,639
	Means	$8,194,834	$10,688,849	$15,539,922	$22,811,447	$14,308,763

investment strategies generate greater ending net worths than the conservative investment strategies by 53 percent. These results also hold true given the specific retirement category (Test D). In general, there appears to be little advantage to using the cash margin to prepay debt as opposed to using it for reinvestment in the farm.

Probability of Meeting Family Living Expenses In Retirement

Table 4.15 reports the probability of meeting living needs during retirement for a producer who requires the equivalent of $30,000 per year for living needs. The range in probabilities for producers with no retirement vehicles (NONE), given Social Security benefits at a level of 30 percent of living needs, is from 0.81 for conservative producers to 0.97 for aggressive producers. An interesting result is the conservative cash preference where 75 percent of the cash margin is used to prepay term debt has a greater probability of meeting living needs than the conservative attitude with a higher percentage going into the farm. As this operation is highly leveraged, prepayment of debt significantly reduces the annual interest expense and acts to increase net worth.

Table 4.15 Probability of Meeting Estimated Family Living Expenses of $30,000 During Retirement for Case II.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	81	96	96	100
	Debt	87	97	97	100
Balanced	Farm	94	100	100	100
	Debt	95	100	100	100
Aggressive	Farm	96	100	100	100
	Debt	97	100	100	100
Dynamic	Farm	95	100	100	100
	Debt	95	100	100	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	81	91	91	98
	Debt	82	94	94	98
Balanced	Farm	91	99	99	100
	Debt	91	99	99	100
Aggressive	Farm	95	100	100	100
	Debt	95	100	100	100
Dynamic	Farm	92	100	100	100
	Debt	92	100	100	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	81	89	89	98
	Debt	81	92	92	98
Balanced	Farm	91	99	99	100
	Debt	91	99	99	100
Aggressive	Farm	94	100	100	100
	Debt	95	100	100	100
Dynamic	Farm	92	100	100	100
	Debt	92	100	100	100

Table 4.16 Probability of Meeting Estimated Family Living Expenses of $60,000 During Retirement for Case II.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	80	82	83	98
	Debt	81	83	83	98
Balanced	Farm	88	98	98	100
	Debt	88	98	98	100
Aggressive	Farm	91	100	100	100
	Debt	91	100	100	100
Dynamic	Farm	91	100	100	100
	Debt	91	100	100	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	79	81	81	98
	Debt	79	81	82	98
Balanced	Farm	85	97	97	100
	Debt	84	97	97	100
Aggressive	Farm	89	100	100	100
	Debt	89	99	99	100
Dynamic	Farm	88	99	99	100
	Debt	88	99	99	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	79	81	81	98
	Debt	79	81	81	98
Balanced	Farm	84	97	97	100
	Debt	84	97	97	100
Aggressive	Farm	88	99	99	100
	Debt	88	99	99	100
Dynamic	Farm	87	99	99	100
	Debt	87	99	99	100

As the level of Social Security benefits decreases, the probability of meeting living needs decreases slightly; however, at the $30,000 level of living needs, reducing Social Security benefits has little impact on the probability of meeting the living needs.

Tables 4.16 and 4.17 report the probability of meeting living needs for estimated living needs of $60,000 and $90,000 during retirement. As expected, the probability of meeting living needs decreases as estimated living needs increase. This is especially true for producers who do not use any form of retirement vehicles. The range in probability for producers who do not utilize retirement vehicles and have living needs equivalent to $90,000 is 0.51 to 0.62. Thus, 40-50 percent of producers in this category will not be able to meet their living needs during retirement. The range of probability of meeting living needs is 0.74-0.96 for producers using IRAs, and 0.79-0.97 for producers using IRAs and a SEP. Clearly, retirement vehicles are important for producers who expect higher levels of living expenses during retirement. As with Case I, there is no significant difference between the probability of meeting living needs for producers who use IRAs and producers who use IRAs and SEPs.

Table 4.18 shows the probability of meeting living needs regardless of cash preference and investment strategy for various levels of Social Security benefits and levels of living needs, given the retirement plan (NONE, IRA, SEP, ALL) for the producer. The range of probabilities when no retirement vehicles are used is 0.58 to 0.93. Given the level of Social Security benefits, the probability of meeting living needs decreases as the level of living needs increases. Pairwise z-tests show significant differences in probabilities between all levels of living needs ($p < 0.006$). Similarly, given the level of annual living needs, the probability of meeting living needs decreases as the level of Social Security benefits decrease. Specifically, there are significant differences in probabilities of meeting living needs between the 30 percent and 10 percent level of Social Security benefits when living needs are $90,000.

For producers utilizing IRAs, the range of probabilities is 0.89 to 0.99. Thus, IRAs greatly increase the probability of meeting living needs during retirement. The

Table 4.17 Probability of Meeting Estimated Family Living Expenses of $90,000 During Retirement for Case II.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	78	81	81	96
	Debt	78	81	81	97
Balanced	Farm	83	97	97	100
	Debt	83	97	97	100
Aggressive	Farm	87	99	99	100
	Debt	87	99	99	100
Dynamic	Farm	85	99	99	100
	Debt	85	99	99	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	65	79	81	94
	Debt	64	79	81	94
Balanced	Farm	71	95	95	100
	Debt	68	95	95	100
Aggressive	Farm	75	97	97	100
	Debt	71	97	97	100
Dynamic	Farm	71	97	97	100
	Debt	70	97	97	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	54	74	79	94
	Debt	54	74	79	94
Balanced	Farm	57	92	94	100
	Debt	57	91	94	100
Aggressive	Farm	62	96	97	100
	Debt	61	96	97	100
Dynamic	Farm	59	96	97	100
	Debt	59	96	97	100

Table 4.18 Probability of Meeting Estimated Family Living Expenses Given Social Security Benefits and/or Family Living Expenses, Regardless of Investment Strategy and Cash Preference (Case II).

Social Security Benefits	Family Living Expenses	NONE	Retirement Category IRA	SEP	ALL
30 %	$30,000	93	99	99	100
	$60,000	88	95	95	100
	$90,000	83	94	94	99
10%	$30,000	90	98	98	100
	$60,000	85	94	94	100
	$90,000	69	92	93	99
0%	$30,000	90	97	97	100
	$60,000	85	94	94	100
	$90,000	58	89	92	99

differences between the proportions across all levels of living needs are all significant at the 0.05 level, except between the $60,000 and $90,000 level of living needs when Social Security provides 30 percent of living needs ($p > 0.16$). Similarly, the combination of SEPs and IRAs produces significant differences between the probability of meeting living needs for most of the combinations. However, the probability of meeting living needs during retirement for producers who use a combination of IRAs and a SEP is greater than 0.90 for all levels of living needs and all levels of Social Security benefits.

The use of IRAs, SEPs, and 401(k) plans virtually assures the producers of meeting their living needs regardless of the level of needs or Social Security benefits. The range for this scenario is 0.99 to 1.00. Thus, use of all retirement plans makes meeting annual living needs an almost certain event.

Table 4.18 also reports the probability of meeting living needs for various levels of retirement planning and Social Security benefits, given a level of living needs. This table indicates that given a level of Social Security, there are significant differences in the probability of meeting living needs due to the use of the various retirement plans ($p < 0.004$). However, as stated above, there is no significant difference between the IRA and SEP categories ($p > 0.35$).

As with Case I, the level of Social Security benefits is important to producers who do not use any retirement plans. This is especially true for producers desiring a higher standard of living during retirement. As the level of Social Security benefits drops from 30 percent to 0 percent, the probability of meeting living needs decreases from 0.8325 to 0.5788 for producers who expect living needs of $90,000 and do not use any retirement vehicles.

Farm Failures

Table 4.19 reports the probability of farm failure for operations with a 65 percent debt/asset ratio. The probability of failure for more highly-leveraged operations is much greater than for the 50 percent debt/asset case. The range of

Table 4.19 Probability of Farm Failure for Case II.

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Farm	20	20	20	20
	Debt	20	20	20	20
Balanced	Farm	20	18	18	15
	Debt	20	18	18	15
Aggressive	Farm	20	16	15	13
	Debt	20	16	15	13
Dynamic	Farm	20	16	15	13
	Debt	20	16	15	13

probability of failure is 0.13 to 0.20 for the highly-leveraged farms. This is expected as higher leverage places greater pressure on cash flow due to higher debt service requirements.

Table 4.19 shows there is no difference in the probability of failure for the conservative producers, regardless of retirement plans utilized. As these producers tend to invest in assets with relatively low returns, they do not obtain the capital growth necessary to maintain their debt/asset ratio below the cutoff level of 75 percent.

For producers with balanced attitudes, the use of IRAs and SEPs lowers the probability of failure from 0.20 to 0.18. IRAs and SEPs tend to reduce the tax liability of the operation, as well as provide less risk exposure through a more diversified portfolio of assets. The tax-deferred growth of the IRAs and SEPs helps the producer maintain a debt/asset ratio lower than 75 percent. The use of 401(k) plans further reduces the probability of failure to 0.15.

Aggressive and dynamic producers can reduce the probability of failure from 0.20 to 0.13 by use of all the retirement vehicles. The use of IRAs lowers the probability to 0.16; SEPs lower the probability to 0.15; 401(k) plans further reduce the probability to 0.13. Again, this reduction is mainly due to greater capital appreciation and diversification of assets.

Diversity of Producer's Portfolio

Similar results are obtained for this case as are obtained for the 50 percent debt/asset ratio case (Table 4.20). With no retirement plans, the producer's assets tend to be heavily concentrated in farm assets. Conservative producers have 92-94 percent of their assets invested in the farm, while aggressive and dynamic producers have 82-86 percent invested in the farm.

The use of IRAs, SEPs, and 401(k) plans greatly reduces the concentration in farm assets. When all retirement plans are utilized, aggressive producers have

Table 4.20 Percentage of Total Assets Invested in Various Asset Categories by Retirement Category, Investment Strategy, and Cash Preference (Case II).

Retirement Category	Investment Strategy	Cash Preference	Asset Category Farm	Liquid	Taxable	IRA	SEP	401(k)
NONE	Conservative	Farm	94%	3%	3%	0%	0%	0%
		Debt	92%	5%	3%	0%	0%	0%
	Balanced	Farm	88%	3%	9%	0%	0%	0%
		Debt	87%	5%	8%	0%	0%	0%
	Aggressive	Farm	83%	3%	14%	0%	0%	0%
		Debt	82%	5%	13%	0%	0%	0%
	Dynamic	Farm	86%	3%	12%	0%	0%	0%
		Debt	84%	5%	11%	0%	0%	0%
IRA	Conservative	Farm	90%	3%	3%	5%	0%	0%
		Debt	88%	5%	3%	5%	0%	0%
	Balanced	Farm	71%	2%	8%	19%	0%	0%
		Debt	70%	4%	7%	20%	0%	0%
	Aggressive	Farm	59%	2%	11%	28%	0%	0%
		Debt	58%	3%	9%	29%	0%	0%
	Dynamic	Farm	61%	2%	9%	28%	0%	0%
		Debt	60%	3%	8%	29%	0%	0%
SEP	Conservative	Farm	76%	2%	2%	5%	15%	0%
		Debt	75%	3%	2%	5%	16%	0%
	Balanced	Farm	50%	1%	5%	15%	29%	0%
		Debt	49%	2%	4%	15%	30%	0%
	Aggressive	Farm	38%	1%	6%	20%	36%	0%
		Debt	37%	1%	4%	20%	37%	0%
	Dynamic	Farm	39%	1%	5%	20%	35%	0%
		Debt	39%	1%	4%	20%	36%	0%
ALL	Conservative	Farm	66%	1%	1%	5%	13%	14%
		Debt	65%	2%	1%	5%	13%	15%
	Balanced	Farm	35%	1%	2%	12%	20%	30%
		Debt	35%	1%	2%	12%	20%	30%
	Aggressive	Farm	24%	0%	2%	15%	23%	35%
		Debt	24%	1%	2%	15%	23%	36%
	Dynamic	Farm	25%	0%	2%	15%	22%	35%
		Debt	25%	1%	2%	15%	23%	35%

approximately 75 percent of their assets invested outside of farm assets. As with Case I, diversifying the portfolio to include the retirement vehicles may greatly reduce cash flow problems at the time of retirement. Diversification may also greatly reduce the amount of risk the producer will face over the planning horizon.

Mean Discounted Cumulative Tax Liability

The ANOVA results for Case II are similar to the results obtained in Case I. There are significant tax advantages to using retirement investment vehicles (Table 4.21). Tests for differences in the mean present value of the tax liability for the 4 retirement categories, regardless of investment strategy or cash preference, show significant differences ($p < 0.0001$). The highest tax liabilities are associated with NONE and IRA. These retirement categories are not significantly different at the 0.05 level. The use of IRAs and SEPs leads to a decrease of 17 percent in the mean present value of tax liability as compared to NONE. Finally, the addition of a 401(k)

Table 4.21 Mean Discounted Cumulative Tax Liability for Case II.

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL	Means
Conservative	Farm	$509,365	$502,297	$423,948	$373,893	$452,443
	Debt	$509,501	$501,344	$424,617	$374,020	$452,371
Balanced	Farm	$516,974	$509,690	$428,899	$377,073	$458,159
	Debt	$516,037	$506,750	$427,947	$376,561	$456,824
Aggressive	Farm	$524,328	$519,935	$435,638	$379,058	$464,740
	Debt	$522,646	$515,910	$433,618	$377,754	$462,482
Dynamic	Farm	$526,236	$521,964	$437,125	$380,279	$466,401
	Debt	$524,276	$517,602	$434,856	$378,819	$463,888
	Means	$518,704	$511,937	$430,831	$377,182	$459,663

plan to the retirement portfolio reduces the operator's tax liability by 27 percent as compared to NONE.

The means of the tax liability are not significantly different between investment strategies or cash preferences. This holds true given a specific retirement category or when retirement categories are aggregated. Different investment strategies and/or different uses of the cash margin (farm reinvestment versus debt prepayment) have no statistical impact on the mean of the tax liability.

Given a specific investment strategy and cash preference, there are significant differences in mean tax liability across the retirement categories. Again, intransitivity is present in the rankings of the means. There is no statistical difference between mean tax liability for NONE, IRA, and SEP. However, for most of the cash preferences there is no difference in mean tax liability for SEP and ALL, even though the mean for ALL is lower than the means for NONE, IRA, and SEP. The results again indicate there are significant tax savings available to producers through use of IRAs, SEPs, and 401(k) plans.

Breakeven Tax Rate at Retirement

The breakeven tax rates for Case II are presented in Table 4.22. In general, the results are very similar to the breakeven tax rates in Case I. For conservative producers, the breakeven tax rate ranges from 61-72 percent, depending on the retirement plans utilized by the producer. For balanced producers, taxes can absorb 89-95 percent of the retirement account before the ending net worth is equal to the ending net worth when no retirement plans are used. The range for aggressive and dynamic producers is 93-99 percent. In the absence of investment tax credits and capital gains taxes, it is clearly more advantageous to invest in tax-deferred accounts for retirement purposes.

Table 4.22 Breakeven Tax Rate at Time of Retirement between NONE and IRA, SEP, and ALL for Case II.

Investment Strategy	Cash Preference	Retirement Category IRA	SEP	All
Conservative	Farm	63%	70%	70%
	Debt	61%	72%	70%
Balanced	Farm	95%	90%	89%
	Debt	90%	89%	93%
Aggressive	Farm	99%	94%	93%
	Debt	94%	93%	93%
Dynamic	Farm	99%	94%	93%
	Debt	94%	93%	93%

Case III: 65 Percent Debt/Asset Ratio for a Producer Who Leases a Majority of His/Her Land

Means of Farm Assets, Total Assets, & Net Worth

Analysis of the means for farm assets, total assets, and net worth for Case III provides results which are very similar to the results for Cases I and II (Tables 4.23-4.25). Rather than repeat the above discussion, this section will briefly summarize the results.

Mean ending farm assets are not significantly affected by any of the 32 scenarios. Investment in retirement vehicles does not significantly reduce the size of the farm. Further, given a retirement category, the producer's investment strategy and cash preference do not have an impact on mean ending farm assets.

Mean total assets and mean ending net worth are significantly larger when retirement vehicles are used. The largest mean ending total assets and mean ending

Table 4.23 Mean Ending Farm Asset Values for Case III.

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL	Means
Conservative	Liquid	$2,544,688	$2,520,933	$2,518,633	$2,505,038	$2,522,323
	Debt	$2,544,688	$2,520,933	$2,518,631	$2,505,031	$2,522,321
Balanced	Liquid	$2,544,688	$2,549,672	$2,547,369	$2,546,893	$2,547,156
	Debt	$2,544,688	$2,549,672	$2,547,367	$2,546,885	$2,547,153
Aggressive	Liquid	$2,544,688	$2,549,672	$2,547,369	$2,561,455	$2,550,796
	Debt	$2,544,688	$2,549,672	$2,547,367	$2,561,448	$2,550,794
Dynamic	Liquid	$2,544,688	$2,549,672	$2,547,369	$2,561,456	$2,550,796
	Debt	$2,544,688	$2,549,672	$2,547,367	$2,561,449	$2,550,794
	Means	$2,544,688	$2,542,487	$2,540,184	$2,543,707	$2,542,767

Table 4.24 Mean Ending Total Assets for Case III.

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL	Means
Conservative	Liquid	$3,901,588	$4,252,047	$5,753,298	$7,078,952	$5,246,471
	Debt	$3,908,198	$4,261,373	$5,770,017	$7,092,265	$5,257,963
Balanced	Liquid	$4,586,689	$6,718,222	$12,716,202	$18,633,914	$10,663,757
	Debt	$4,632,063	$6,768,960	$12,783,400	$18,684,678	$10,717,275
Aggressive	Liquid	$5,273,278	$9,165,499	$19,654,542	$30,155,008	$16,062,082
	Debt	$5,357,282	$9,257,090	$19,771,856	$30,243,764	$16,157,498
Dynamic	Liquid	$4,967,678	$8,694,349	$18,590,882	$28,512,567	$15,191,369
	Debt	$5,048,330	$8,782,201	$18,702,738	$28,596,189	$15,282,365
	Means	$4,709,388	$7,237,468	$14,217,867	$21,124,667	$11,822,347

net worth are generated by use of all retirement vehicles. The ending total assets for ALL are almost 3.5 times larger than the ending total assets for NONE. SEP generates ending total assets and ending net worth more than twice as large as the ending total assets and ending net worth for NONE. There is no significant difference between the means for NONE and IRA, indicating IRAs do not have a major impact on total assets or net worth. This is expected, as the allowable tax-deductible contributions to IRAs are reduced to zero for producers earning higher levels of income, as is the case for many of the replications. Thus, one would not expect a significant difference in net worth or total assets due to the use of tax-deductible IRA contributions.

As expected, aggressive and dynamic investment strategies generate the largest ending total assets and net worth. Values for ending total assets and net worth for the aggressive and dynamic attitudes are 190-206 percent greater than for the conservative attitude. Balanced attitudes tend to provide lower ending total assets and net worth than the aggressive and dynamic attitudes, while conservative attitudes consistently

Table 4.25 Mean Ending Net Worth for Case III.

Investment Strategy	Cash Preference	NONE	IRA	SEP	ALL	Means
		Retirement Category				
Conservative	Liquid	$3,876,954	$4,195,780	$5,675,670	$6,881,045	$5,157,362
	Debt	$3,886,800	$4,208,103	$5,695,195	$6,897,548	$5,171,912
Balanced	Liquid	$4,532,046	$6,661,658	$12,637,775	$18,411,958	$10,560,859
	Debt	$4,610,664	$6,715,273	$12,707,823	$18,465,898	$10,624,915
Aggressive	Liquid	$5,248,628	$9,108,930	$19,576,043	$29,918,791	$15,963,098
	Debt	$5,335,881	$9,203,402	$19,695,984	$30,010,712	$16,061,495
Dynamic	Liquid	$4,943,043	$8,637,790	$18,512,436	$28,276,467	$15,092,434
	Debt	$5,026,932	$8,728,515	$18,627,351	$28,363,234	$15,186,508
	Means	$4,682,619	$7,182,431	$14,141,035	$20,903,207	$11,727,323

generate the lowest ending values. Further, there is no significant difference in mean ending values for total assets or net worth due to use of the cash margin for reinvestment in the farm versus prepayment of debt.

Probability of Meeting Family Living Expenses In Retirement

The probability of meeting living needs during retirement for a producer who leases a majority of the land for his/her operation are listed in Tables 4.26-4.28. Table 4.26 lists the probability of meeting living needs for a producer who expects annual living needs equivalent to $30,000. For producers who do not use any retirement vehicles, the probability of meeting living needs ranges from 0.92 to 0.94 when Social Security provides 30 percent of estimated living needs. The probability increases to 1.00 when any retirement plans are utilized. Pairwise z-tests indicate the difference in probabilities between NONE and any of the other retirement plans is highly significant ($p < 0.007$).

Table 4.26 Probability of Meeting Estimated Annual Family Living Expenses of $30,000 During Retirement for Case III.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL
Conservative	Farm	92	100	100	100
	Debt	92	100	100	100
Balanced	Farm	94	100	100	100
	Debt	94	100	100	100
Aggressive	Farm	94	100	100	100
	Debt	94	100	100	100
Dynamic	Farm	94	100	100	100
	Debt	94	100	100	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL
Conservative	Farm	84	98	99	100
	Debt	84	98	99	100
Balanced	Farm	87	100	100	100
	Debt	86	100	100	100
Aggressive	Farm	87	100	100	100
	Debt	87	100	100	100
Dynamic	Farm	87	100	100	100
	Debt	87	100	100	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL
Conservative	Farm	82	96	98	100
	Debt	81	96	98	100
Balanced	Farm	82	100	100	100
	Debt	82	100	100	100
Aggressive	Farm	85	100	100	100
	Debt	85	100	100	100
Dynamic	Farm	84	100	100	100
	Debt	83	100	100	100

As Social Security benefits decrease to 10 percent of living needs, the probability of meeting total living needs decreases. The range for NONE is 0.84-0.87. When compared to a range of 0.98-1.00 for all of the retirement categories, the difference in probabilities is again highly significant ($p < 0.0003$). Similar results are obtained when Social Security decreases to 0 percent. These results demonstrate the importance of retirement vehicles in providing adequate investment and liquidity during the retirement years.

Table 4.27 shows the probabilities of meeting living needs for producers expecting living needs equivalent to $60,000 per year. When no retirement plans are utilized the range of probability is 0.70-0.76. Thus, approximately one-quarter of the producers will not be able to meet their annual living expenses when Social Security provides 30 percent of their needs. There is a significant difference ($p < 0.04$) in probabilities between NONE and IRA. The range of probabilities for IRA is 0.81 for conservative producers to 1.00 for aggressive producers. Thus, IRAs are useful in assisting producers meet their needs during the retirement years.

For a level of Social Security equal to 30 percent, there is not a significant difference in probabilities between IRA and SEP, except for the conservative producers ($p < 0.0515$). For the conservative producers the probability of meeting their living needs increases from 0.81-0.82 to 0.90 by utilizing a SEP. SEPs are not as important for less conservative producers.

When Social Security falls to 10 percent of estimated living needs, the probability of meeting living needs decreases to 0.52-0.65 for producers not using any retirement plans. Thus, approximately one-third to one-half of producers in this category will not be able to meet a level of living needs equivalent to $60,000 per year. The probability for producers who use IRAs also decreases dramatically from when Social Security provides 30 percent of living needs. This is especially true for conservative producers.

Table 4.27 Probability of Meeting Estimated Annual Family Living Expenses of $60,000 During Retirement for Case III.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Liquid	70	82	90	98
	Debt	70	81	90	98
Balanced	Liquid	74	96	98	100
	Debt	74	96	98	100
Aggressive	Liquid	76	100	100	100
	Debt	76	100	100	100
Dynamic	Liquid	75	97	99	100
	Debt	75	97	99	100

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Liquid	52	64	79	97
	Debt	52	64	79	97
Balanced	Liquid	59	84	98	100
	Debt	59	84	98	100
Aggressive	Liquid	65	93	98	100
	Debt	65	93	98	100
Dynamic	Liquid	58	87	98	100
	Debt	59	87	98	100

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Liquid	47	59	75	95
	Debt	48	59	75	95
Balanced	Liquid	55	81	97	99
	Debt	55	81	97	99
Aggressive	Liquid	59	84	98	100
	Debt	60	85	98	100
Dynamic	Liquid	55	83	98	99
	Debt	55	83	98	99

In contrast to Case I and Case II, there is a significant difference in probabilities between IRA and SEP ($p < 0.04$). Less conservative producers who use IRAs and SEPs have a 0.98 probability of meeting their needs during retirement, while conservative producers face a 0.79 probability of meeting their needs. Thus, SEPs, in combination with IRAs, are very important for producers who lease a majority of their land. Further, 401(k) plans, used in combination with IRAs and a SEP, virtually assure producers of meeting their needs. The range for ALL is 0.97-1.00. Similar results are obtained when a Social Security level of 0 percent is assumed.

The probability of meeting living needs for producers expecting living costs of $90,000 during retirement is shown in Table 4.28. Trends similar to the $60,000 scenario are apparent in Table 4.28. The range of probabilities, given Social Security at 30 percent, is 0.45 for conservative producers to 0.59 for aggressive producers when no retirement vehicles are used. Again, there is a significant difference between IRA and SEP, indicating the importance of the SEP. 401(k) plans again virtually assure the producer of meeting living needs during retirement.

When Social Security provides 10 percent of living needs, the decrease in probability is dramatic. The range for producers not using any retirement vehicles is 0.24 to 0.43. Thus, approximately 55-75 percent of producers will not be able to continue living at a standard equivalent to $90,000. The range in probabilities for producers using IRAs is from 0.32 for conservative producers to 0.71 for aggressive producers. SEPs are important in providing additional funds for retirement, especially for the less conservative producers. Again, 401(k) plans virtually assure all but the conservative producers of meeting their living needs during retirement.

A level of 0 percent benefits from Social Security dramatically affects producers not using all available retirement plans. Those using no retirement plans face probabilities ranging from 0.17 for conservative producers to 0.34 for aggressive producers. IRAs do not benefit the conservative producers supplement their retirement financial position as compared to using no retirement plans ($p > 0.29$). However, there

Table 4.28 Probability of Meeting Estimated Annual Family Living Expenses of $90,000 During Retirement for Case III.

When Social Security Provides Benefits of 30% of Family Living Needs

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL
Conservative	Liquid	45	57	74	93
	Debt	45	56	74	93
Balanced	Liquid	53	77	94	99
	Debt	53	77	94	99
Aggressive	Liquid	59	83	98	100
	Debt	59	83	98	100
Dynamic	Liquid	54	82	98	99
	Debt	54	82	98	99

When Social Security Provides Benefits of 10% of Family Living Needs

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL
Conservative	Liquid	24	32	63	75
	Debt	24	32	63	75
Balanced	Liquid	37	59	83	97
	Debt	37	59	83	97
Aggressive	Liquid	41	70	94	99
	Debt	43	71	94	99
Dynamic	Liquid	37	65	90	98
	Debt	38	65	91	98

When Social Security Provides Benefits of 0% of Family Living Needs

Investment Strategy	Cash Preference	Retirement Category NONE	IRA	SEP	ALL
Conservative	Liquid	17	20	58	72
	Debt	17	20	58	72
Balanced	Liquid	29	51	77	96
	Debt	30	51	77	96
Aggressive	Liquid	34	60	88	98
	Debt	34	60	89	97
Dynamic	Liquid	31	59	81	97
	Debt	31	59	81	97

Table 4.29 Probability of Meeting Estimated Family Living Expenses Given Social Security Benefits and/or Family Living Expenses, Regardless of Investment Strategy and Cash Preference (Case III).

Social Security Benefits	Family Living Expenses	NONE	Retirement Category IRA	SEP	ALL
30 %	$30,000	94	100	100	100
	$60,000	74	94	97	100
	$90,000	53	75	91	98
10%	$30,000	86	100	100	100
	$60,000	59	82	93	99
	$90,000	35	57	83	92
0%	$30,000	83	99	100	100
	$60,000	54	77	92	99
	$90,000	28	48	76	91

is a very significant difference ($p < 0.0003$) between IRA and SEP for this scenario.

Table 4.29 lists the probability of meeting living needs (regardless of investment strategy and cash preference) for all levels of Social Security benefits and all levels of living needs, given the retirement category. This table shows dramatic differences in the probability of meeting living needs as both Social Security benefits decrease and the level of living needs increase. Z-tests show strongly significant differences ($p < 0.0000$) across all level of living needs, given the level of Social Security benefits. Similarly, there are strongly significant differences ($p < 0.05$) in probability across all levels of Social Security benefits, given the level of living needs. Thus, when no retirement plans are used the level of Social Security coverage is a key factor in helping producers meet their living needs.

When IRAs are part of the retirement portfolio, the level of living needs has a large impact on the producer's ability to meet living needs. Again, given the level of Social Security coverage, there are strongly significant differences ($p < 0.0000$) in probabilities as living needs increase. Similarly, given the level of living needs, decreases in the level of Social Security coverage significantly decreases the probability of meeting living needs.

The use of SEPs further improves the producer's probability of meeting living needs during retirement. The range for this case is 0.76 to 1.00. The probability decreases significantly as the level of living needs increases ($p < 0.0000$). The probability also decreases as the level of Social Security coverage decreases. However the differences are not significant between Social Security coverage of 10 percent and 0 percent for living needs of $30,000 and $60,000.

When all retirement plans are used the range of probability is 0.91 to 1.00. Again, the combination of IRAs, SEPs, and 401(k) plans is very useful in helping the producer meet his/her living needs during retirement.

Table 4.29 also presents the probability of meeting living needs for various retirement plans and levels of Social Security coverage, given the level of living needs. The probability of meeting living needs decreases significantly as the level of Social Security coverage decreases for most of the retirement categories. The main exception occurs for $30,000 level of needs when all retirement plans are used.

The above results indicate producers who lease a majority of their land should seriously consider investing in IRAs, SEPs, and/or 401(k) plans. The underlying reason for this result is these producers do not have the asset base at the age of retirement to generate a sufficient stream of income to meet living needs. They are paying rent each year rather than building equity through purchase of assets such as land. Further, producers who lease a majority of their assets do not benefit from tax-deductible depreciation and interest expenses; thus, increased income taxes may reduce the cash margin available for investment. The lack of equity in the farm at retirement makes investment in retirement vehicles very important to producers who lease a majority of their property.

Farm Failures

The probability of failure for this scenario ranges from 0.02 to 0.06 (Table 4.30). Conservative producers again face the greatest probability of failure. Interestingly, conservative producers who do not use any retirement vehicles have a 0.05 probability of failure as compared to 0.06 for producers who use any or all of the retirement plans available. A possible reason for this is that retirement investments put additional pressure on cash flow during the planning horizon. Cash invested in these retirement vehicles, besides earning a relatively low return in conservative assets, is not readily available to the producer should cash flow problems arise. This may increase the need for operating loans, which may force the debt/asset ratio above the 75 percent cutoff.

Probability of failure for the less conservative producers decreases from 0.05 to 0.04 through use of IRAs and SEPs. The probability of failure is further reduced by use of 401(k) plans in combination with IRAs and SEPs. This is expected, as the

Table 4.30 Probability of Farm Failure for Case III.

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL
Conservative	Liquid	5	6	6	6
	Debt	5	6	6	6
Balanced	Liquid	5	4	4	3
	Debt	5	4	4	3
Aggressive	Liquid	5	4	4	2
	Debt	5	4	4	2
Dynamic	Liquid	5	4	4	2
	Debt	5	4	4	2

growth of the more aggressive portfolios helps the producer maintain a debt/asset ratio below the 75 percent cutoff.

As opposed to the 65 percent debt/asset ratio where the producer has purchased a majority of his/her property, the probability of failure for producers with a similar debt/asset ratio, but who lease their property is much lower. This reflects the fact that leasing is a much more flexible arrangement than purchasing land. Leasing land reduces the annual debt service and thus, reduces cash flow pressure on the operation. One would expect the probability of failure to be lower for operations in which land is leased as opposed to operations in which the land is owned by the producer.

Diversity of the Producer's Portfolio

The portfolio for a producer who leases a majority of the land for his/her operation will not be as heavily concentrated in farm assets as the portfolio for a producer who owns a majority of the land for his/her operation. This is demonstrated in Table 4.31. The assets of a leasing producer who uses no retirement plans are spread between the farm, the liquid account, and the taxable portfolio. The farm comprises 65 percent of total assets for a conservative producer. The remaining 35 percent is mainly invested in the liquid account (29 percent). For the balanced producers, 55 percent of total assets are invested in the farm, 25 percent is in the liquid account, and 20 percent is in a taxable portfolio. For the aggressive and dynamic producers, approximately one-half of total assets are in the farm, with the remaining 50 percent evenly distributed between the liquid account and the taxable account.

When IRAs are utilized, the conservative producers have 10 percent invested in the IRAs, 25 percent in the liquid account and 59 percent in farm assets. Farm assets comprise only 28-29 percent of the portfolio for the aggressive and dynamic producers. These producers have between 43 and 44 percent of their total assets in IRAs. Thus, aggressive producers have more than 70 percent of their assets in nonfarm investments.

Table 4.31 Percentage of Total Assets Invested in Various Asset Categories by Retirement Category, Investment Strategy, and Cash Preference (Case III).

Retirement Category	Investment Strategy	Cash Preference	Asset Category Liquid	Liquid	Taxable	IRA	SEP	401(k)
NONE	Conservative	Liquid	65%	29%	6%	0%	0%	0%
		Debt	65%	29%	6%	0%	0%	0%
	Balanced	Liquid	55%	25%	19%	0%	0%	0%
		Debt	55%	25%	20%	0%	0%	0%
	Aggressive	Liquid	48%	22%	29%	0%	0%	0%
		Debt	47%	22%	30%	0%	0%	0%
	Dynamic	Liquid	51%	24%	25%	0%	0%	0%
		Debt	50%	24%	26%	0%	0%	0%
IRA	Conservative	Liquid	59%	25%	5%	10%	0%	0%
		Debt	59%	25%	5%	10%	0%	0%
	Balanced	Liquid	38%	16%	13%	33%	0%	0%
		Debt	38%	16%	13%	33%	0%	0%
	Aggressive	Liquid	28%	12%	16%	44%	0%	0%
		Debt	28%	12%	17%	43%	0%	0%
	Dynamic	Liquid	29%	13%	14%	44%	0%	0%
		Debt	29%	13%	15%	43%	0%	0%
SEP	Conservative	Liquid	44%	15%	3%	9%	30%	0%
		Debt	44%	15%	3%	9%	30%	0%
	Balanced	Liquid	20%	7%	5%	20%	49%	0%
		Debt	20%	7%	5%	19%	49%	0%
	Aggressive	Liquid	13%	4%	6%	23%	54%	0%
		Debt	13%	4%	6%	23%	54%	0%
	Dynamic	Liquid	14%	5%	5%	23%	54%	0%
		Debt	14%	5%	5%	23%	54%	0%
ALL	Conservative	Liquid	35%	10%	2%	8%	24%	21%
		Debt	35%	9%	2%	8%	24%	21%
	Balanced	Liquid	14%	4%	3%	15%	32%	32%
		Debt	14%	4%	3%	15%	32%	32%
	Aggressive	Liquid	8%	2%	3%	17%	34%	35%
		Debt	8%	2%	3%	17%	34%	35%
	Dynamic	Liquid	9%	2%	2%	17%	34%	35%
		Debt	9%	2%	3%	17%	34%	35%

The diversity of the portfolio becomes even greater when SEPs are used in combination with IRAs. Conservative producers in this category have 44 percent of their assets in the farm, and 30 percent in the SEP. Aggressive producers tend to have 13-14 percent of total assets in the farm versus 54 percent in the SEP and 23 percent in the IRA.

The use of 401(k) plans in combination with IRAs and SEPs slightly reduces the percent of assets invested in the farm. Conservative producers have portfolios which are evenly distributed between the farm (35 percent), the SEP (24 percent), and the 401(k) plan (21 percent). The remaining 20 percent is mainly divided between the liquid account and the IRAs.

For aggressive producers, only 8-9 percent of total assets are invested in the farm. These producers have 17 percent invested in IRAs, 34 percent invested in SEPs, and 35 percent in 401(k) plans. Thus, over 90 percent of the assets for these producers is invested off the farm.

The above results indicate producers who lease a majority of their land tend to be more diversified than producers who own a majority of their land. However, while they may be more diversified, they are less likely to meet their living needs during retirement. This is direct result of not building a sufficient asset base that will generate the needed annual income during the retirement years. Thus, there is a trade-off: more diversity and lower probability of farm failure versus lower probability of meeting living needs during the retirement years. The use of nonfarm retirement investments can make this trade-off less of a factor to the producer who leases his/her land. By using the available retirement vehicles, the producer increases the level of diversification, lowers the probability of farm failure, and greatly increases the probability of meeting his/her living needs during retirement.

Table 4.32 Mean Discounted Cumulative Tax Liabilities for Case III.

Investment Strategy	Cash Preference	NONE	Retirement Category IRA	SEP	ALL	Means
Conservative	Farm	$485,989	$474,373	$410,812	$359,636	$432,703
	Debt	$488,690	$477,220	$412,694	$361,417	$435,005
Balanced	Farm	$495,554	$484,355	$417,034	$364,100	$440,261
	Debt	$498,959	$487,988	$419,391	$366,020	$443,090
Aggressive	Farm	$505,721	$494,346	$423,716	$368,766	$448,137
	Debt	$509,809	$498,680	$426,494	$451,548	$371,208
Dynamic	Farm	$506,715	$495,366	$424,696	$369,648	$449,106
	Debt	$510,791	$499,686	$427,506	$372,096	$452,520
	Means	$500,279	$489,002	$420,293	$366,611	$444,046

Mean Discounted Cumulative Tax Liability

Results relating to the mean tax liability are similar to the results from Cases I and II (Table 4.32). In general, producers receive no tax savings from use of IRAs; however, significant tax savings are possible by using a SEP and/or a 401(k) plan in combination with an IRA. ALL generates a cumulative tax liability which is 27 percent lower than the tax liability for NONE. Further, there are no tax advantages related to investment strategy or use of the cash margin to prepay debt rather than reinvest in the operation ($p > 0.99$).

Breakeven Tax Rate at Retirement

Breakeven tax rates for Case III are presented in Table 4.33. The results are similar to those presented for Cases I and II. Conservative producers can have their retirement accounts taxed at rates of 71-80 percent before ending net worth is equal to the ending net worth for producers who do not use retirement accounts. Balanced,

Table 4.33 Breakeven Tax Rate at Time of Retirement between NONE and IRA, SEP, and ALL for Case II.

Investment Strategy	Cash Preference	Retirement Category IRA	SEP	All
Conservative	Liquid	71%	80%	78%
	Debt	72%	80%	78%
Balanced	Liquid	94%	93%	92%
	Debt	95%	93%	92%
Aggressive	Liquid	96%	95%	94%
	Debt	97%	94%	94%
Dynamic	Liquid	97%	95%	95%
	Debt	97%	95%	94%

aggressive and dynamic producers can face average tax rates of 92-97 percent before the advantage to tax-deferred investments is lost.

Comparison of Results Across Cases I, II, and III

Cases I, II, and III model agricultural operations with different degrees of ownership. Case I models a situation where the producer purchases/finances a majority of his/her assets and starts the planning period with a debt/asset ratio of 50 percent; Case II models a more highly-leveraged operation (65 percent debt/asset ratio) for a producer who purchases/finances a majority of his/her assets; Case III models the situation where a highly-leveraged operator (65 percent debt/asset ratio) leases a majority of the land for his/her operation. Each form of ownership has implications related to ending farm assets, ending net worth, probability of meeting living needs during retirement, probability of farm failure, diversity of the producer's portfolio and tax liability.

Mean ending farm assets decrease as the degree of leverage increases, regardless of retirement category, investment strategy, or cash preference. Case I provides the highest mean ending farm assets of the three capitalization cases. The lower degree of leverage puts less pressure on cash flow in the form of smaller annual debt service requirements. Thus, ceteris paribus, the cash margin available for investment should be larger for an operation with a lower degree of leverage. This allows greater investment in the farm operation. As expected, the leasing scenarios (Case III) generate the lowest mean ending farm assets.

As with mean ending farm assets, mean ending net worth decreases as the degree of leverage increases. Besides starting the planning period with higher net worth, lower annual debt service requirements for Case I help to build net worth faster than in Cases II and III. The leasing scenarios generate the lowest ending net worth. Lease payments do not build equity as they merely purchase the right to use the services of an asset rather than purchasing the asset itself. Under the assumptions of this research, the profits for the operation which leases a majority of its land are not reinvested in the operation, thus slowing the rate at which equity is accumulated.

In general, the greater the degree of ownership, the greater the probability of meeting expected living needs during retirement. The probability of meeting living needs is greatest across all categories for the operation with the 50 percent debt/asset ratio. These operations have the highest maximum probabilities, as well as the highest minimum probabilities of meeting desired living needs of the three ownership cases. These operations have higher levels of equity at age of retirement than the operations in Case II and Case III. Accordingly, the higher equity for the Case I operations is capable of providing a larger stream of annual income during the retirement years than the lower equity operations in Cases II and III.

Operations with a 65 percent debt/asset ratio (Case II) tend to have higher probabilities of meeting living needs than operations which lease a majority of their land (Case III), especially for higher levels of living needs. Operations in Case II have a significantly higher probability of meeting living needs than Case III when living needs are expected to be $90,000. The operations which lease tend to have greater probabilities of meeting living needs when expected living needs are $30,000. However, the differences between Case II and Case III are relatively small. The main difference between Case II and Case III occurs at the higher levels of living needs, regardless of retirement plans used.

The probability of farm failure is lowest for operations in Case I and Case III. The range of probability of failure is 0.03-0.05 for these cases, compared to 0.13-0.20 for Case II. This results indicates operations with a higher degree of leverage are more likely to fail. This may be due to the higher annual debt service associated with these operations. The less-leveraged operations and the leased operations tend to have lower annual debt service requirements, and thus, less pressure on cash flow. Further, the leased operations are more flexible in that the producer may cancel the lease with relative ease.

The diversity of the producer's portfolio is vastly different between the ownership cases (I and II) and the leasing case (III). The leased operation tends to be more diverse than the operations in Cases I and II. This is to be expected, as the operator who leases land has much less capital invested in the farm. This allows a greater percentage of capital to be allocated to nonfarm assets, such as the liquid account, the taxable account, and the retirement vehicles. Again, leasing provides for greater diversity of assets at the cost of having a lower probability of meeting the desired level of living needs during retirement.

Discounted cumulative tax liability decreases as the degree of leverage increases, regardless of retirement category, investment strategy, or cash preference. The largest tax liability is generated by the operation with the 50 percent debt/asset ratio. Operations with a 65 percent debt/asset ratio (Cases II and III) have lower tax liabilities than the operation in Case I. A major reason for this result is operations with higher degrees of leverage (Cases II and III) have larger tax-deductible expenses (interest expense and lease payments) than the operation in Case I.

In summary, the use of retirement vehicles is more important for operations with higher degrees of leverage. Highly-leveraged operations tend to have smaller cash margins available for investment due to larger annual debt service requirements. This leads to slower growth of the producer's assets and net worth than for operations with lower degrees of leverage. Use of retirement vehicles is of even greater importance for operations which lease of majority of their assets (Case III). Although these operations provide a greater degree of diversity in the producers' portfolios and they are less likely to fail (under the assumptions of this research), they do not prepare the operator for a secure retirement. These operations have lower mean ending farm assets and net worth than operations which purchase or finance their assets. The smaller net worth is typically insufficient to generate an annual income stream large enough to meet family living needs during retirement.

Chapter 5

Summary and Conclusions

"Stupid is as stupid does." Forrest Gump

Retirement planning is typically a neglected function in personal financial management. Over one-half of the US population between the ages of 18 and 34 have not begun to save for retirement, while one-fourth of US adults between the age of 35 and 54 have no retirement savings. This is reflected in the decreasing national savings rate for US adults. Amazingly, nearly one out of every three adults over the age of 65 have no income from savings during their retirement years.

Agricultural producers tend to view investment in the farm as their retirement portfolio. While investment in the operation may be profitable, it may result in a relatively risky, insufficient, and illiquid portfolio at the age of retirement. The operator may face cash flow problems as he/she is forced to liquidate farm assets to meet living needs during retirement.

Qualified retirement investments such as IRAs, SEPs, Keoghs, and 401(k)/403(b) plans are powerful financial planning tools currently available to agricultural producers. These plans offer annual tax deductions as well as tax-deferred growth of both principal and earnings until the funds are withdrawn at the age of retirement. However, these investment vehicles are not widely used by the US population. Less than 30 percent of the population have IRAs or Keogh plans, while less than one-third of the US workforce participates in 401(k) plans.

As a result of relatively low participation in these retirement vehicles, a majority of the retired population must depend on the Social Security Administration for income during the retirement years. Previous studies estimate Social Security benefits are the major source of income for 62 percent of US retirees, and these benefits provide more than 90 percent of income for 15 percent of retirees. While Social Security benefits are currently an extremely important source of income for retirees, the current workforce must consider the impact on their retirement income if the Social Security Administration trust fund becomes bankrupt or extends reduced benefits to retirees. Retirement plans such as IRAs, SEPs, and 401(k) plans may aid members of the workforce in minimizing the impact of this possible decrease in retirement income.

This study is designed to analyze the impacts on an agricultural operation of investing in retirement vehicles. The main objective of this study is to investigate several pre-retirement investment scenarios for farm families. This objective allows analysis of wealth accumulation, liquidity at age of retirement, investment risk, and the tax implications associated with retirement investments. A secondary objective is to determine the implications of an increase in the marginal tax rate at the time of retirement on the attractiveness of retirement investments.

To accomplish the objectives of this study, a spreadsheet simulation model is developed to determine the wealth accumulation, liquidity at retirement, investment risk, and tax implications of various retirement plans. Specifically, the model examines four retirement options for the operator: 1) no retirement plans used, 2) IRAs used for producer and spouse, 3) IRAs and a SEP used, and 4) IRAs, SEP, and 401(k) used by the operator and/or spouse. The model simulates the annual cash flows and capital appreciation for three separate farm capitalization cases. These cases model different methods of capitalizing the operation. The three farm cases are: Case I - 50 percent debt/asset ratio; Case II - 65 percent debt/asset ratio; Case III - 65 percent debt/asset ratio for an operator who leases a majority of the land for his/her operation. These cases allow investigation of the impacts of retirement investments under different methods of capitalization. Further, four investment strategies are examined for each case:

a. Conservative
b. Balanced
c. Aggressive
d. Dynamic (moving from Aggressive to Conservative over time).

This design allows examination of the impacts of different investment strategies on the wealth accumulation, liquidity, tax liability, and risk of farm failure.

In addition to the retirement categories, capitalization methods, and investment strategies, this study also examines different uses of the cash margin available for investment. For Cases I and II, 30 percent of the cash margin is equally divided between the liquid account, the taxable portfolio, and excess family living. The remaining 70 percent is divided between investment in the farm and prepayment of term debt. The two cash margin investment scenarios are:

a. 75 percent allocated to farm investment - 25 percent allocated to prepayment of debt, and
b. 25 percent allocated to farm investment - 75 percent allocated to prepayment of debt.

For Case III, 20 percent of the cash margin is equally divided between the taxable portfolio and excess family living. The remaining 80 percent is divided between the liquid account and prepayment of term debt as follows:

a. 75 percent allocated to the liquid account - 25 percent allocated to prepayment of debt, and
b. 25 percent allocated to the liquid account - 75 percent allocated to prepayment of debt.

These cash preference scenarios allow analysis of the impacts on retirement investments due to different uses of the cash margin. The combination of different retirement options, capitalization methods, investment strategies, and cash preferences allows investigation of a wide range of producer/operation characteristics. In total, thirty-two scenarios are modelled for each capitalization method.

The purpose of the analytical model is to simulate farm and nonfarm investment scenarios for the operation. The spreadsheet model simulates the annual cash flows for an agricultural operation over a 30-year period. Stochastic interest rates, rates of return on investment portfolios, cash receipts/total farm assets, and cash expense/cash receipts ratios are used to simulate an actual operating environment. These stochastic variables (for each of the 30 years in the planning period) are generated using a 2-lag vector-autoregressive (VAR) model. The VAR model, based on historical data from 1940-1988, captures the trends in each variable, variability around the mean for each variable, and the correlation between each of the variables. To reduce the probability of using non-representative stochastic variables, 100 replications are run for each scenario. Each replication uses a different matrix of stochastic variables.

The stochastic variables are used to simulate the annual cash flows for the operation. For each year, the cash margin available for investment is calculated. The cash margin is allocated as discussed above. The cash margin allocations are designed to allow analysis of the impacts of reinvesting in the operation versus prepaying term debt. After allocating the cash margin as specified by the scenario, the ending asset and liability accounts are adjusted to reflect operations for the year. The asset accounts are adjusted for inflation, physical depreciation, capital growth, capital purchases, and/or capital liquidation. The liability accounts are adjusted to reflect principal repayment and/or additional borrowing. This process provides the mean ending account balances for the variables of interest at the end of the planning period.

To assess impacts on wealth accumulation across the 32 scenarios, the model reports mean ending values (for all replications) for farm assets, total assets, and net worth at the end of the 30-year period. Four statistical tests are conducted to compare the mean ending values for farm assets, total assets, and net worth. The first test (Test A) compares the means across retirement categories, regardless of investment strategy and/or cash preference. Test B compares the means across investment strategies and cash preferences, regardless of retirement category. Test C compares the means across retirement category, given a particular investment strategy and cash preference, while Test D compares means across investment strategy and cash preference, given a particular retirement category. For each test, means are analyzed for statistical differences using analysis of variance (ANOVA) and Bonferroni t-tests. An overall level of significance of 0.05 is used for all analyses.

To assess impacts on liquidity at the age of retirement, model results indicate the diversity of the operator's portfolio at the age of retirement. The model reports ending values for farm assets, the liquid account, the taxable account, IRAs, SEP, and 401(k) as a percentage of total assets. The percentages are tested for statistical differences between scenarios using z-tests. Again, a 0.05 overall level of significance is used.

The risk associated with each scenario is measured in two ways. First, the probability of meeting estimated living needs during retirement is calculated for each scenario. Meeting living needs is defined as having an ending net worth capable of generating an income stream, in addition to Social Security benefits, larger than the operator's estimated annual living needs during the retirement years. The second risk measure reported by the model is the probability of farm failure. A farm is considered to be a failure if the debt/asset ratio for the operator exceeds 75 percent.

Results related to tax implications are reported in two methods. The first method is the mean discounted total Federal tax liability for the operator. The annual income taxes and self-employment taxes are calculated by the model. To compare the tax liability for each scenario, each annual tax liability estimate is discounted to the present by the average inflation rate for the planning period. The discounted annual tax liabilities are summed and the mean for the 100 replications for each scenario is calculated. By comparing the mean discounted tax liability for each scenario, it is possible to examine tax implications due to the use of various retirement plans, capitalization method, investment strategies, and cash preferences. Comparisons are made using the same four tests (A, B, C, D) as is used to compare means for ending farm assets, total assets, and net worth.

The second method of examining tax implications is calculation of the breakeven tax rate on retirement investments at the age of retirement. This is the tax rate at which all tax-advantages of retirement investments are eliminated. The breakeven tax rate is calculated assuming the current marginal tax rates remain constant until the age of retirement for the operator, and there are no deferred taxes on farm assets or assets in the taxable portfolio. The assumption of no deferred taxes may seem unrealistic; however, it provides the most conservative estimate for the breakeven tax rate.

Summary of Results

Mean ending values for discounted tax liability, farm assets, total assets, and net worth are tested for significant differences (Tests A, B, C, and D) using analysis of variance (ANOVA) procedures and Bonferroni t-tests. P-values for ANOVA procedures are reported in Chapter 4 to indicate the level of significance of the test. An overall level of significance of 0.05 is used for the ANOVA procedure and the Bonferroni t-tests. The following is a general overview of the results of this research.

Investment in qualified retirement plans, such as IRAs, SEPs, and 401(k)s, has a significant impact on wealth accumulation ($p < 0.0001$). In general, the use of retirement vehicles leads to increased mean ending total assets and net worth. The use of IRAs is not of great importance in building wealth because of the phase-out of tax-deductible annual IRA contributions based on adjusted gross income. However, the use of SEPs and 401(k) plans dramatically increases the mean ending total assets and net worth for producers. For Case I, the use of all retirement vehicles (ALL) generates mean ending total assets 200 percent greater than the use of no retirement vehicles (NONE). Mean ending net worth for ALL is 150 percent greater than mean ending net worth for NONE in Case I. For Case III, the use of all retirement vehicles generates mean ending total assets 3.5 times larger than when no retirement vehicles are utilized.

Investment in IRAs, SEPs, and/or 401(k)s does not significantly reduce total farm assets, under the assumptions of the model ($p > 0.90$). Thus, the size and growth of the farm are not affected by investing funds in retirement accounts instead of investing funds in the farm. This result holds true regardless of the degree of leverage for the operation.

Investment strategy has a major impact on the total assets and net worth. Aggressive and dynamic investment strategies typically generate significantly larger mean ending total assets and net worth. For Case I, these investment strategies generate ending total assets 86-95 percent larger than the conservative strategies. Ending net worth for the aggressive and dynamic strategies is 92-102 percent greater than the conservative strategies. Aggressive and dynamic investment strategies for Case III generate ending total assets (and net worth) 190-206 percent greater than the conservative strategies.

In general, there is little advantage to using the cash margin for prepaying debt versus reinvesting in the farm. These uses of the cash margin do not have significant impacts on ending total assets or net worth. Similarly, there are no significant differences in mean discounted tax liability between these cash preferences.

The probability of meeting estimated living needs during retirement is relatively high (0.95-1.00 for Case I;0.81-1.00 for Cases II and III) for producers with low estimated living needs ($30,000/year), regardless of retirement plan, investment strategy, or level of Social Security benefits. However, the model assumes the producer begins the planning period with substantial net worth. As the level of living needs increases, the probability of meeting living needs tends to decrease. There is relatively little difference in probability of meeting living needs between the use of IRAs and a combination of IRAs and a SEP ($p > 0.04$). However, use of these plans tends to provide an annual stream of income much greater than the estimated living needs.

The level of Social Security benefits has relatively little impact on the probability of meeting living needs when living needs are expected to be low. Social Security benefits become more important as the level of living needs increases. This is especially true for producers who lease a majority of their land.

The probability of farm failure is not significantly affected by the use of retirement plans, investment strategies, or uses of the cash margin for Cases I and III. The probability of farm failure is similar between operations starting with a 50 percent debt/asset ratio and operations starting with a 65 percent debt/asset ratio which lease a majority of their land. For these cases, the probability of farm failure varies between 3-6 percent for various combinations of retirement plans and investment attitudes. The probability of farm failure for operations starting with a 65 percent debt/asset ratio (without leasing land) is dramatically higher. The range of probability of failure for this case is 13-20 percent. The use of all retirement plans tends to decrease the probability of farm failure, especially for the aggressive and dynamic producers. This is a result of the nonfarm investments maintaining the debt/asset ratio below 75 percent.

The diversity of the producer's portfolio is similar across all methods of capitalization. With no retirement plans, the producer's assets are heavily concentrated in farm assets. For conservative investment strategies in Case I, the percentage of total assets invested in farm assets ranges from 91-94 percent. As more retirement plans are utilized, the percent of assets invested in the farm decreases. This is especially true for the aggressive and dynamic producers. For example, in Case I when all retirement vehicles are used, producers with conservative investment strategies have 67 percent of total assets invested in the farm, whereas producers with aggressive investment strategies only have 25 percent of their total assets invested in the farm. Aggressive and dynamic producers who use all retirement plans tend to have more capital invested in nonfarm assets than they have invested in farm assets.

The tax liability for each case is not significantly reduced by the use of IRAs. Again, this is due to the phase-out of allowable contributions to IRAs. SEPs and 401(k)s significantly reduce the producer's tax liability over the planning period ($p < 0.0001$). Tax liability is not affected by investment strategy or use of the cash margin to prepay debt versus investment in the farm.

The breakeven average tax rate for the retirement categories is quite high for all methods of capitalization. The breakeven tax rate between IRAs and the use of no retirement plans is greater than 60 percent for the conservative producers. This indicates the average tax rate at the time of retirement must be greater than 60 percent (for conservative producers) to negate the advantages of investment in IRAs. The breakeven tax rate for less-conservative producers is greater than 90 percent. As SEPs and 401(k)s are used, the breakeven tax rate increases further.

The degree of leverage has an impact on the producer's preparation for retirement. In general, as the degree of leverage increases, investment in retirement vehicles becomes more important. This is especially true for operators who lease a majority of their assets. While greater degrees of leverage may reduce the annual tax liability, it tends to put more pressure on annual cash flow through increased debt service requirements. This reduces the cash margin available for investment, which tends to slow the growth of the producer's equity. For operations which lease their assets, the slower growth in equity leads to an insufficient retirement portfolio (farm and nonfarm) at the age of retirement. Thus, producers who lease their assets and do not invest their profits for retirement will have difficulty meeting their family living needs during retirement.

Implications

The results of the analytical model provide interesting implications for agricultural producers and for policy-makers. This section briefly discusses the major implications identified in this study.

From a policy standpoint, two major retirement issues need to be examined. First, IRAs, under current legislation, are not useful to commercial agricultural producers (gross annual revenues > $100,000). Under the assumptions of this study, producers do not obtain significant tax benefits through the use of IRAs. This is due to the limit on tax-deductible contributions to IRAs. With the current ceiling on adjusted gross income ($50,000 for married producers filing joint tax returns), the commercial agricultural producers simulated in this study are typically not able to make tax-deductible contributions to IRAs. Thus, they do not qualify for tax deductions offered by IRAs. If the Federal government has interest in reducing the burden on Social Security, legislation concerning the phase-out of tax-deductible IRA contributions should be investigated. This implication is not limited to agricultural producers. Any taxpayer with a relatively high adjusted gross income faces reduction or elimination of tax-deductible IRA contributions.

The second policy implication is related to Social Security benefits. The results of this study indicate Social Security benefits are not important for producers who expect relatively low living needs during retirement. Social Security benefits are more important for producers who expect higher levels of living needs during retirement, and for producers who lease a majority of the land for their operation. The use of retirement vehicles, such as IRAs and SEPs, reduces the producer's reliance on Social Security benefits. Policy changes which allow greater use of retirement plans may significantly reduce the US population's dependence on Social Security benefits. Specifically, an increase in the maximum adjusted gross income for which individuals qualify for tax-deductible IRA contributions, or an increase in the maximum allowable annual IRA contribution may help reduce dependence on Social Security. By reducing the dependence on Social Security benefits, the Social Security Administration may gain more flexibility in managing its trust fund. Thus, changes in retirement investment legislation may have policy implications for the Social Security Administration.

Further implications of the results of this study relate to the agricultural producers. Producers can significantly improve their preparation for retirement by using qualified retirement plans, such as IRAs, SEPs, and 401(k)s. Use of these plans typically leads to increased mean ending total assets and net worth. Although IRAs are not extremely helpful in building wealth, the use of SEPs and 401(k) plans dramatically increases the mean ending total assets and net worth for producers. Higher net worth at time of retirement translates into a better financial position for the producer. This higher net worth is capable of providing a larger annual income stream during retirement than when no retirement plans are utilized. Interestingly, farm size and growth is not significantly reduced by investment in IRAs, SEPs, and/or 401(k)s.

Investment strategy has significant impacts on ending total assets and net worth. Aggressive and dynamic investment strategies typically generate significantly larger mean ending total assets and net worth than the balanced and conservative investment strategies. An important implication of this result is a relatively small difference exists between the aggressive and the dynamic investment strategies. The dynamic attitude, where the producer changes his/her investment strategy from aggressive to conservative over time, produces slightly lower ending net worth than the aggressive attitude; however, the difference is generally not statistically significant. Further, the dynamic investment strategy exposes the producer to less investment risk as retirement approaches. Thus, a producer with a dynamic investment strategy can generate a similar ending net worth as the aggressive producer, but face lower investment risk as retirement approaches. Lower risk as retirement nears may provide a greater level of comfort for producers.

Retirement investments help the producer reduce his/her total tax liability over the planning period. SEPs and 401(k) plans provide significant tax savings, as compared to use of no retirement vehicles. As producers tend to be concerned with minimizing their tax liability, the use of retirement investments can reduce the tax liability without significantly reducing the size of growth of the farm.

Producers also tend to be concerned with changes in the marginal tax rates as a reason not to investment in retirement plans. The breakeven average tax rate calculated in this study may assist producers in deciding whether to invest in retirement plans. The breakeven tax rate implies investment in retirement plans is more advantageous as long as the tax rate is less than 60 percent at the time of retirement (assuming the current marginal tax rates remain constant) for conservative producers. For less-conservative producers, investment in retirement plans is advantageous as long as the tax rate at retirement is less than 90 percent. Given the current maximum marginal tax rate is 39.6 percent, the likelihood of a tax rate of 90 percent at retirement is minimal. Thus, investment in IRAs, SEPs, and 401(k)s is advantageous as long as tax rates remain below 60 percent.

The ability to meet living needs during retirement is typically a major concern of producers. Income during retirement may come from rent or sale of the farm assets, Social Security benefits, and from nonfarm investments such as IRAs and SEPs. Rent of farm assets, Social Security benefits, and income from nonfarm assets tend to be fairly liquid. That is, they provide income without a major effort. However, sale of farm assets to generate income during retirement may be time- and effort-consuming. Further, liquidation of farm assets may involve significant tax implications. Thus, the more diverse the producer's portfolio at retirement, the more likely the producer will be able to meet cash flow needs. Without retirement plans, the producer's portfolio tends to be heavily concentrated in farm assets. The diversity of the portfolio is significantly improved by use of retirement plans. With the use of IRAs, SEPs, and 401(k)s, the aggressive and dynamic producers have more assets invested in nonfarm assets than they have in farm assets. This diversity may greatly facilitate meeting living needs at the time of retirement. It may also greatly ease the transition of the operation to the next generation.

A final implication for producers is related to the trend of increased leasing of land. Leasing has positive and negative implications for the producer. The positive implications of leasing are reduced tax liability, decreased probability of farm failure, as compared to operations with similar leverage positions who do not lease land, and increased diversity of the producer's portfolio. Leasing provides a more flexible method of obtaining the services of assets than ownership of the assets. This flexibility, along with lower annual debt service requirements, helps the producer survive difficult economic times. Leasing also requires less capital investment in farm assets; thus, more funds may be available for investment in nonfarm assets. On the negative side, leasing does not allow the producer build equity as rapidly as ownership of assets. This leads to lower net worth at the time of retirement. Lower net worth, in turn, makes it harder to meet living needs during retirement. Thus, the probability of meeting living needs during retirement decreases for producers who lease a majority of their land. Further, Social Security benefits are more important in assisting producers who lease a majority of their assets to meet their estimated living needs.

The results of this research have marketing implications for the financial services industry. Financial institutions may use the results of this study to market retirement plans and investments to the agricultural community. By explaining to the agricultural producer (and his/her spouse) the benefits of retirement investments, such as increased ending net worth, reduced tax liability, and increased probability of meeting estimated living needs, the institution may increase sales volume of qualified retirement investments.

Suggestions for Future Research

There has not been extensive research in the field of retirement planning and investing for agricultural producers. This study attempts to analyze the impacts of retirement investments for agricultural producers. However, there are limitations to this study which may be addressed in future research. The scope of research in this field is vast, indicating several possible areas of study in future research.

This research focusses on a small segment of the retirement planning and investment field. There are several parameters in this research which can be altered to analyze different aspects of retirement investing. For example, this research simulates a sole proprietorship which generates from $100,000 to $350,000 in annual gross revenues. The operator is assumed to be married with 2 children. The model assumes fairly specific investment scenarios, as related to capitalization, investment strategies, and uses of the cash margin available for investment. Future research may expand the scope of this study by analyzing different farm sizes (in terms of farm assets), specific enterprises (such as dairy, beef, crop, orchard, etc.), and different operator characteristics (age, number of dependents or employees, business organization, etc.). Further, future research may analyze different uses of the cash margin; different percentages for investment in the farm, the liquid account, the taxable portfolio, family living, and debt prepayment.

Further study in the area of risk attitudes of the producers is recommended. Comparison of different investment strategies across producers of varying risk attitudes may help determine which strategies are preferred. Use of expected return-variance (EV Analysis) or stochastic dominance may provide valuable information for producers.

Another suggestion for future research is to simulate retirement investing for nonfarm small businesses. While the results of this research may be applicable to small businesses, research in this area is recommended. With over 16 million small businesses in the US, the audience for research in the small business field is sizable.

A final suggestion for future research in the retirement investment field is related to income tax policies. This study assumes marginal tax rates remain constant at their current levels. Future studies may provide more insight into the advantages or disadvantages of retirement investment under various income tax policies.

APPENDICES

Appendix A

Vector-Autoregressive Model

A 2-lag vector-autoregressive (VAR) model is used to model the intertemporal relationships between each of the eight rates simulated in this study:

Farm Revenues as a Percent of Total Farm Assets
Farm Cash Expenses (Excluding Interest) as a Percent of Farm Cash Receipts
Rate of Return to Farmland
Standard & Poor's 500 Market Index
Rate of Return for US Treasury Bills
Annual Rate of Inflation (Nominal)
Federal Land Bank Long-Term Interest Rates
Production Credit Association intermediate-Term Interest Rates

The data for the VAR model consist of the historical rates for these variables for the period 1940-1988.

The VAR model captures the intercorrelations between all of the variables as well as their cyclical nature. The model developed to simulate these rates contains two lags and no contemporaneous variables. Dummy variables are used to eliminate obvious outliers in the years 1946 and 1973. The observations for 1946 may have been exceptional due to post-World War II shocks, while the 1973 observations may have been influenced by the oil crisis of the early 1970s.

Specifically, the VAR model is defined as:

$$X_t = \alpha_0 + \sum_{i=1}^{2} \alpha_i X_{t-i} + \beta D_t + u_t$$

where X_t = an 8x1 vector of the variables at time t,

D_t = a 2x1 vector of dummy variables,

α_0 (8x1), α_i (8x8), and β (2x1) are the unknown parameters to be estimated, and

u_t = an 8x1 vector of residuals.

Tests to determine whether one, two, or three lags should be incorporated into the system indicate the 2-lag model is the most appropriate model. The Rao approximate likelihood ratio test clearly indicates the 2-lag model is superior to the 3-lag model ($p = 0.721$) (Rao). The Rao test for the 1-lag model versus the 2-lag model indicates the 1-lag model cannot be rejected (in favor of the 2-lag model) at an alpha level of 0.05, but can be rejected at an alpha level of 0.10. The two-lag model is chosen over the 1-lag model to more completely capture the cyclical nature of the variables and to ensure against possible omitted variable bias.

The coefficients for the 2-lag VAR model are presented in Table A1. The model residuals are judged to be normally distributed on the basis of equation-by-equation normality tests and full system normality tests (Small Normality Tests; Mardia Normality Tests; Multivariate Jarque-Bera Normality Tests) (Spanos; Mardia).

The VAR model provides the regression coefficients necessary to generate the expected rates for each variable. However, to more fully capture variation around the conditional means, a randomly-generated residual is added to each equation. The generated residuals are distributed multivariate-normal, with mean of zero and a variance-covariance matrix equivalent to the estimated VAR residual variance-covariance matrix. Different vectors of randomly-generated residuals are used to generate a different set of rates for each replication.

To generate the stochastic variables using the 2-lag model requires historical rates for two base years. The base year rates for each variable are randomly selected from the period 1940-1988 for each of the 100 replications. However, the historical values for the years 1946 and 1973 are not considered for use as base years as they are judged to be statistical outliers.

Once the 2 base year data and the randomly-generated residuals are known, a time series of each of the stochastic variables can be generated. Though the study requires a 30-year series of each variable for each replication, a 230-year series is initially generated, from which only the last 30 years are used in the simulation model. The rates for the first 200 years are generated to eliminate any special characteristics of the series due to the selection of the base years (initial conditions).

Table A1. Regression Coefficients Generated Using the Vector-Autoregressive Model.

Regression Estimates for Rates of Return

	Land	SP500	T-Bills	Inflation	FLB	PCA	Exp/Rec	Revenue
Constant	1.36569	0.06517	-0.06277	0.43596	-0.05669	-0.00158	1.02208	-0.18206
Dummy1946	-0.00432	-0.27595	-0.00460	0.13433	0.00018	-0.00107	-0.09937	0.06206
Dummy1973	0.00830	-0.13955	0.02093	0.03371	0.00236	0.01005	-0.09965	0.07322
Land-1	0.58225	0.86086	-0.01596	0.09550	0.00290	0.00252	0.22675	-0.15687
SP500-1	0.13020	-0.14935	0.03518	0.04040	0.00621	0.01571	0.05155	-0.02567
T-Bill-1	3.54372	-1.56184	0.96961	1.10299	0.30061	0.57547	1.26752	-0.35235
Inflation-1	0.17990	-0.62835	0.16466	0.45727	0.03293	0.06721	-0.47957	0.36513
FLB-1	1.02682	0.11038	-0.62515	0.04175	0.85869	-0.16955	1.68463	-0.20490
PCA-1	-6.64940	8.62640	-0.10087	-1.01821	-0.06143	0.57261	-1.56807	0.16683
Exp/Rec-1	-0.57548	-0.58710	0.10923	-0.27354	0.03026	0.06661	-0.03765	0.19548
Revenue-1	-0.07023	-2.03859	-0.02954	-0.39723	0.02339	-0.00257	-0.68265	0.74139
Land-2	-0.00595	-0.59188	0.03520	0.03855	0.01040	0.00956	0.04107	-0.07489
SP500-2	-0.01172	-0.51238	0.00061	-0.01637	-0.00457	-0.00287	-0.00716	-0.02831
T-Bill-2	0.60168	-2.98843	-0.35559	-0.42777	-0.29676	-0.65764	0.90389	-0.42124
Inflation-2	-0.43318	-1.03737	-0.00103	-0.33127	-0.01154	-0.00514	-0.21389	0.14550
FLB-2	2.95490	-3.44059	0.74632	1.94230	-0.16901	0.30937	0.60458	-1.16744
PCA-2	-0.31333	3.98530	-0.12301	-0.50325	0.25113	0.30040	-0.78103	0.94991
Exp/Rec-2	-0.73746	0.07577	0.00369	-0.18260	0.03512	-0.05504	-0.11006	0.11226
Revenue-2	-1.45662	2.06689	0.01847	-0.25322	0.05186	-0.03157	-0.58641	0.25869

Constant	- α_0 for each variable
Dummy1946	- Dummy variable to eliminate the observations for 1946
Dummy1973	- Dummy variable to eliminate the observations for 1973
Land-1	- Rate of Return on Farm Land (1 lag)
SP500-1	- Standard & Poor 500 Market Index (1 lag)
T-Bill-1	- Rate of Return on US Treasury Bills (1 lag)
Inflation-1	- Nominal Annual Rate of Inflation (1 lag)
FLB-1	- Federal Land Bank Long-Term Interest Rate (1 lag)
PCA-1	- Production Credit Association Intermediate-Term Interest Rate (1 lag)
Exp/Rec-1	- Cash Expense (excluding Interest)/Cash Receipts (1 lag)
Revenue-1	- Gross Revenue/Total Farm Assets (1 lag)
Land-2	- Rate of Return on Farm Land (2 lags)
SP500-2	- Standard & Poor 500 Market Index (2 lags)
T-Bill-2	- Rate of Return on US Treasury Bills (2 lags)
Inflation-2	- Nominal Annual Rate of Inflation (2 lags)
FLB-2	- Federal Land Bank Long-Term Interest Rate (2 lags)
PCA-2	- Production Credit Association Intermediate-Term Interest Rate (2 lags)
Exp/Rec-2	- Cash Expense (excluding Interest)/Cash Receipts (2 lags)
Revenue-2	- Gross Revenue/Total Farm Assets (2 lags)

Appendix B

Time Value of Money Formulae

The following notation is used in the time value formulae,

PV = Present Value

FV = Future Value

Ann = Annuity

PVA = Present Value of an Annuity

FVA = Future Value of an Annuity

i = periodic interest rate

g = periodic rate of growth of the annuity

n = number of periods

Present Value of a Lump Sum:

$$PV = FV \times (1+i)^{-n}$$

Future Value of a Lump Sum:

$$FV = PV \times (1+i)^{n}$$

Annuities:

$$Ann = PV\ x\ \frac{i}{(1-(1+i)^{-n})}$$

Present Value of an Annuity:

Assuming cash flow occurs at the end of the period

$$PVA = Ann\ x\ \frac{(1-(1+i)^{-n})}{i}$$

Assuming cash flow occurs at the beginning of the period

$$PVA = Ann\ x\ [\frac{(1-(1+i)-n)}{i} + 1]$$

Future Value of an Annuity:

Assuming cash flow occurs at the end of the period

$$FVA = Ann\ x\ \frac{((1+i)^{n}-1)}{i}$$

Assuming cash flow occurs at the beginning of the period

$$FVA = Ann\ x\ [\frac{((1+i)^{n}-1)}{i}-1]$$

Present Value of a Constant Growth Annuity:

$$PVA = Ann_0 \; x \; [1 + \frac{(1+i) \; x \; (1 - [\frac{(1+i)}{(1+g)}]^n)}{(g-i)}]$$

Where Ann_0 = the initial annuity (at time 0)

i = average nominal inflation rate for each replication

g = average return for conservative assets for each replication

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VITA

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I was born on December 3, 1963 in Baltimore, MD. I grew up on a small farm in Jarrettsville, MD, where I was very active in 4-H. I received my BS in Agricultural Economics from Virginia Tech in 1985. I then received my MS in Agricultural Economics from The Ohio State University in 1987. The area of specialty for my MS was Farm Management and Agricultural Finance. I published 2 journal articles from my thesis on storage of forage for beef cow-calf operations. After completing my MS, I remained at OSU as a research assistant, working on the Ohio Farm Family Longitudinal Survey.

I became an Instructor of Agricultural Economics at Virginia Tech in 1988. My main responsibilities involved teaching agricultural business courses in the Agriculture Technology program. I taught courses in Farm Management, Agribusiness Management, Computer Applications, Introductory Agriculture Business, and general core courses for the Ag Tech program. I was also responsible for recruiting, student advising, and administrative duties related to the Ag Tech program and the Ag Econ department. After teaching full-time for 2 years I began as a part-time graduate student (PhD.) in the Agricultural Economics department at Tech. The area of interest for my PhD. is Agricultural Finance and Agribusiness Management.

While an instructor and graduate student at Tech I was very active with the Ag Econ/NAMA Club, Block & Bridle, Alpha Gamma Rho, and the Ag Tech Club. The Ag Econ/NAMA Club voted me Outstanding Teaching Faculty Member in 1992, while the Ag Tech Club voted me Outstanding Teacher for 4 of the 6 years I taught in the Ag Tech program.

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