Trading in Human Capital

The next three chapters will focus on the effects the integrated approach to ALM has on various aspects of the insurance business. The thesis of this paper is that the nature of the business of insurance lies in creation of derivative securities that match the supply of securities (stocks, bonds, mortgages, etc.) with the demand for securities from the household and corporate sectors. This means that the essence of our business is in restructuring cash flows. As pointed out in Chapter 3, this has implications for the valuation and management of the insurance firm. In particular, the implication is that ALM acquires the central focus in insurance firm management.

One more implication of this perspective is that, in order to understand the business, we should understand not only our own cash flows, but also the cash flows of our customers to fully comprehend their reasons for acquiring our products. To do this, we need to analyze three major modes of insurance:

- Individual demand for insurance (also within group purchases, because it is individual demand that drives the formation of groups).
- Corporate demand for insurance.
- Social demand for insurance, which arises from specific combination of individual demand and social purposes.

This chapter will focus on individual demand for insurance. It has always been understood that the business of life insurance is very closely related to the life cycle of income and expenditures of individuals (Black and Skipper 1994). In the early years of the adult life, death protection is generally the overwhelming concern, while accumulation of assets slowly acquires importance over time. In the retirement years, the risk of outliving one's money becomes more important than death protection. These stages have given rise to various forms of the traditional life insurance business, which provide protection against untimely death, or untimely life. The changes in the financial industry, and especially in the insurance industry, discussed in Chapter 3, have brought about the new status of ALM and stressed the connection between insurance and banking within the general framework of financial intermediation.

Chalke (1996) discusses this changing perspective and points out that insurance purchased by individuals, both life and property-casualty, is instrumental in helping consumers balance their personal balance sheets. Let us examine this statement. In the absence of capital assets, consumers possess only one other source of income: *human capital.* Indeed, human capital is defined by Gwartney and Stroup (1995) as the education and skills acquired by a person in order to produce future employment income. But human capital does not produce income matching the liabilities stream of its owner. This income production, starting with initial employment, generally rises over time, levels off between ages 50 and 60, and then suddenly drops at retirement. It also requires an initial investment in education. Therefore, when both human capital and expenses of the household are taken as a portfolio, this ''security'' generates net cash flows that are initially negative, then positive, and then again negative. One can divide the human life cycle into the following three major periods:

- Education (i.e., creation of human capital), resulting in a net negative cash flow.
- Production (i.e., utilization of human capital), resulting in a net positive cash flow.
- Retirement or disability (i.e., exhaustion of human capital), resulting in a net negative cash flow.

The challenge lies in the personal balance sheet ALM. This includes not only financing the above combination of negative and positive cash flows, but also creating options that individuals need for their balance sheets. Individuals face the background risks of death or disability, both causing a dramatic drop in the value of their human capital, which cannot be diversified by them, but can be diversified by firms insuring them. As a result of that, the main function of insurance is not to diversify (as insured individuals would assume), but to integrate the cash flows of asset

and liabilities of diversified pools of individuals. Chalke (1996) asserts that this can be represented by the following subfunctions:

- Pure Insurance: term life, disability, health, automobile, home, and liability coverage.
- Pure Derivative Security: annuities, certificates of deposit, pension plans, consumer loans.

Many products, such as whole life or health insurance, contain elements of both pure insurance and a derivative. However, the separation between the two: insurance and derivatives, is not necessarily as pure as Chalke (1996) presents it. The pure insurance products are also derivatives. For example, the consumer's economic balance sheet can be presented as follows:

- Assets: human capital (present value of future earnings stream); accumulated real (e.g., home, cars) and financial (e.g., pensions, savings, investments, etc.) assets; and pure insurance and options acquired.
- Liabilities: present value of future human capital expenses, including taxes on human capital; present value of future personal and family expenses, other taxes, and medical expenses; and debt issued (mortgages, including home mortgages and car loans, and debentures, including credit card debt and personal lines of credit outstanding).

This does not include any derivatives written by individuals, because it is quite rare for individuals to be the writers of options of any kind. But it is common for individuals to hold them. The most obvious one in the United States is the widely held option to prepay one's home mortgage or a car loan, as well as the option to pay off a credit card balance.

Let us look at disability insurance from that perspective. For most consumers, especially in the early stages of their lives, the key asset of the personal balance sheet is their human capital. It is subject to background risks that are not related to the market risk. As stated in Chapter 1, economic decision makers who are subject to a nonmarketable background risk will tend to be purchasers of options. We have already observed that insurers tend to be interest rate option writers to the public (which faces the background risks of human capital) and to the corporate industrial sector (which faces the industry-specific background risks). But life, health and disability insurance products effectively offer options on the net position.

Human Capital—Human Capital Expenses

Consider the following example. Let human capital expenses be at 25% of human capital income. Consider a disability insurance policy that provides 60% replacement for human capital income. This policy is an option granted by the insurer to the insured. Should the human capital value drop below 60% of its initial value, the insured has an incentive to put effectively his or her human capital to the insurance company in exchange for the exercise price of 60% of the original human capital value. Of course the policy must provide for specific conditions that would allow the exercise of the put, and such conditions generally set the strike price to be at 0% (i.e., when human capital becomes worthless, the put can be exercised—note that this effectively creates a put that is exercised at a different price than its strike price). Also note that, if rehabilitation is an open option in the contract, the delivery of the human capital to the insurance company is real. Furthermore, the insurance company which, at disability, is short an annuity to the insured, retains a call on that annuity should rehabilitation prove successful.

The case of term life insurance is even clearer. This is definitely a put on human capital, with the exercise price being the amount of insurance, and the strike price of zero (no chance of rehabilitation here, although cryonic suspension services are offered by several U.S.-based companies). One could venture here to ask why the existing life insurance products recognize the link between the human capital and the amount of insurance only to a limited degree. There are several implications of this model that can be pointed out immediately.

First, any attempt to insure based on anything other than human capital (e.g., the needs of the third party, or future investment income of the insured) is highly debatable and may lead to moral hazard (this part is commonly acknowledged) or undermine the competitive position of the life insurance industry. This also means that one must view the integrated picture of the life cash flows of individuals when insuring them, and not ignore the effects of savings and taxes.

Second, human capital value is highly uncertain and depends on an individual's efforts to increase one's education and skills. However, it is quite clear that, for diversified groups of individuals, the maximum value of human capital (on the present value basis) is achieved near the point of full acquisition of education and expertise. It would, therefore, be quite natural for the exercise price of the human capital put (i.e., insurance amount) to be lowered as the value of human capital decreases over time. As earnings from human capital cease, there does not seem to be anything left to insure.

Figure 5 illustrates this idea. Assume some small salaries while in college, 3% real rate in salaries from age 22 (college graduation) through age 40, then 10 years of growth at 4%, followed by 10 years of growth at 2%, and finally 1% through retirement at age 65, with expenses growing at 1% before age 60 and 3% thereafter (due to medical expenses). The graph, which resembles a similar idea of Chalke (1996), shows the lifetime cash flows for an average individual in a diversified group (i.e., it ignores the death and/or disability related options). Note that salary ranges represent those of a college professor, not an actuary.

Figure 5 clearly illustrates the mismatch of asset and liability cash flows of a typical individual consumer. Place on top of this the need for catastrophic-type options on human capital (death, disability) or real assets acquired (catastrophic property damage) and it is easy to see the need individuals have for restructuring their cash flows. In addition, at any point in life, one can prospectively estimate the value of human capital by discounting future cash flows. If we do so under the assumptions presented above, discount actuarially using the illustrative table of Bowers et al. (1986), and assume no savings on the part of individuals, we arrive at the graph in Figure 6.

Note that individuals face a rapid decline, all the way to negative values, of their human capital at retirement. We also are presented with what one could call the *actuarial explanation of the mid-life crisis,* as the maximum of human capital value is obtained at age 40, followed by rapid decline. But if we change the cash flow stream by introducing a permanent 10% savings rate, invested at 5%, we arrive at the graph of human capital value presented in Figure 7. And, under the stated assumptions, a 20% savings rate, shown in Figure 8, results in human capital value being an increasing function.

A savings rate as high as 20% seems unreasonable in the United States, but if we consider payments for options desired by consumers (such as death, disability, or catastrophic loss protection) to be a part of their overall savings pattern, we conclude that a number as high as 20% may indeed be reasonable. Therefore, in addition to providing options related to nondiversifiable background risk related to human capital (such as death, disability and catastrophic expense options) the main function of life insurance firms lies in the creation of derivative securities that accommodate the savings pattern necessary to avoid having negative human capital value, or, as we could term it, *human capital insolvency.*

The picture is further complicated by interest rate options, and related items, present in the consumers' balance sheets. Life insurance and annuities generally offer an interest rate call, by featuring a minimum interest rate guarantee, and an interest rate put, by featuring provisions to follow a certain index of interest rates, or allowing tax-free 1035 exchanges to other annuities (which may pay higher, competitive market rates). But consumers who own homes also possess options in their personal balance sheet. They have the right to refinance their mortgages, and they enjoy home price appreciation under high inflation scenarios generally associated with high nominal interest rates. The refinance provision is effectively the right to call the existing mortgage (note issued by the consumer). Thus, consumers who own homes and buy annuities and life insurance products often find them-

FIGURE 5
ASSET AND LIABILITY CASH FLOWS OF AN UNINSURED INDIVIDUAL

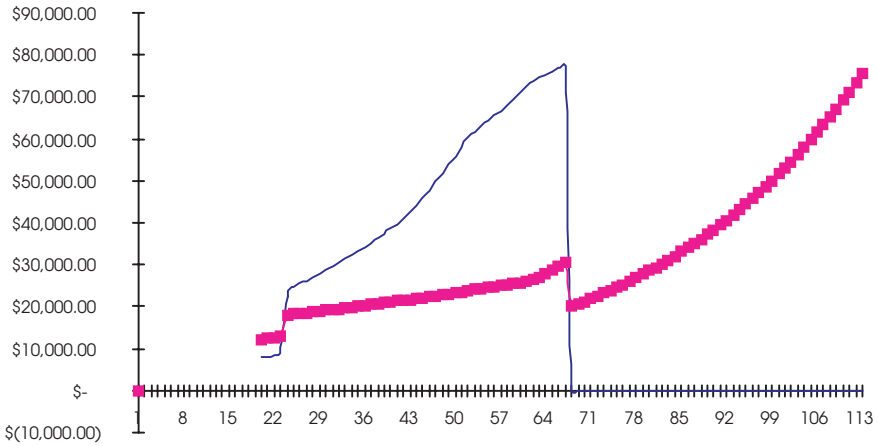
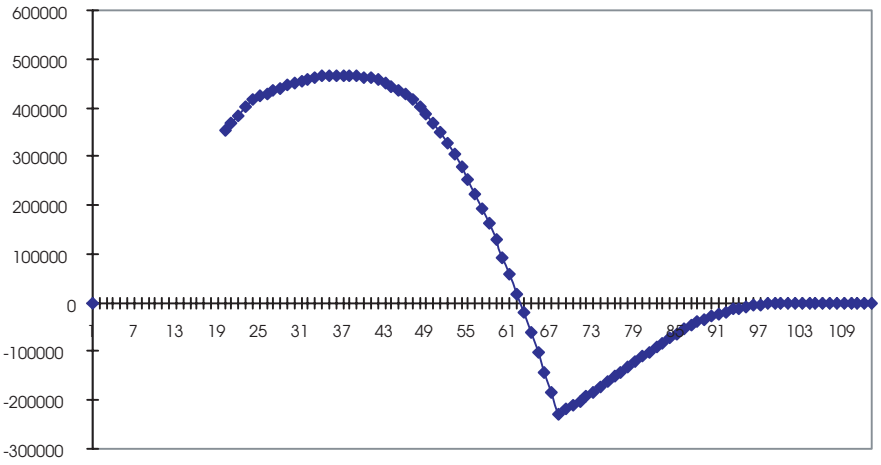


FIGURE 6
VALUE OF UNINSURED HUMAN CAPITAL AT VARIOUS AGES



selves holding the same option twice. This also means that, in a competitive market, they will *pay* for the same option twice.

The strict regimen of the Standard Nonforfeiture Law and the predominance of prepayable mortgages may not necessarily be the best prescription for the consumers. A young couple with children may be better off purchasing a term life insurance policy than paying for the refinancing option in the higher mortgage cost. It should be noted that, in many countries in the world, including Canada and Germany, mortgage originators do not automatically offer the refinancing option. A middle-aged consumer with a stable job may not need a minimum interest rate guarantee by being already partially hedged against falling interest rates through his or her mortgage prepayment option and the stability of employment. In fact, the costs of these guarantees may have worked against the life insurance industry in its competitive struggle for consumer savings vis-à-vis the mutual fund industry and banking industry.

The picture of the consumers' balance sheet is further complicated by taxes. Tax structure may result in the insurers offering tax shelters in addition to options on human capital and other derivatives. As valuable as this service is, it creates a danger of losing sight of the main mission of the business in the context of the personal balance sheet ALM. However, taxes may of-

FIGURE 7
VALUE OF HUMAN CAPITAL WITH 10% SAVINGS RATE

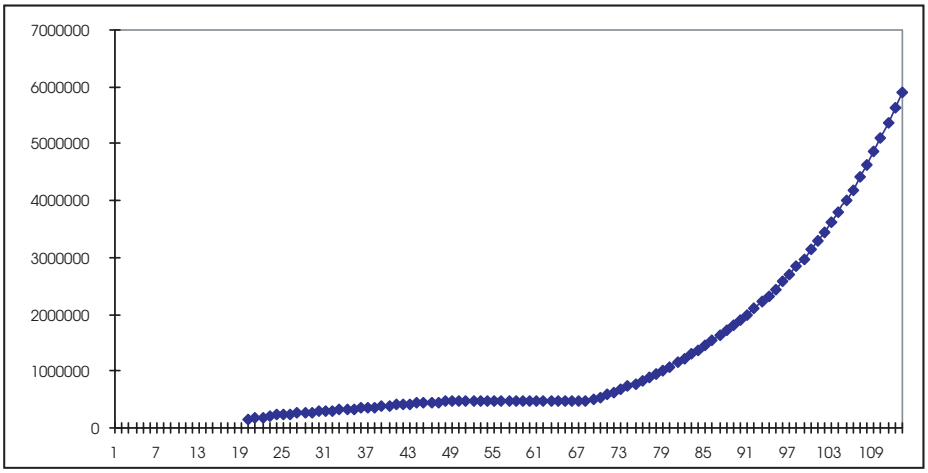
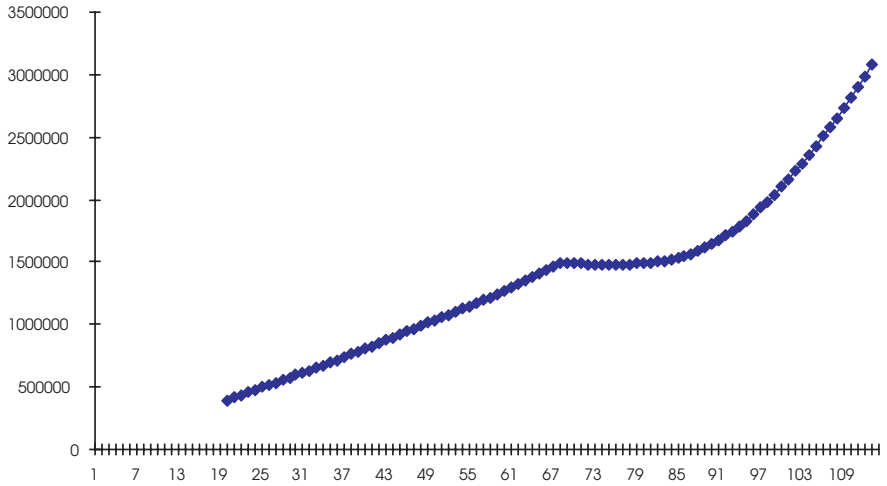


FIGURE 8
VALUE OF HUMAN CAPITAL WITH 20% SAVINGS RATE



fer unique arbitrage opportunities that may provide new markets for the industry. The classical example of such an arbitrage is expressed by the insurance firm purchasing a pool of securities for a customer within a tax-deferred account, as opposed to the customer buying a similar pool of securities in a regular form and having to pay taxes on the income generated by it.

The issues can be further complicated in the case of pension plans. If an employer issues bonds and uses the proceeds to fund a pension plan for employees, he or she is generally prevented from purchasing his or her own bonds in the pension plan (in the United States, this would represent a violation of the 1974 Employee Retirement Income Security Act). However, he or she can purchase a portfolio of bonds with similar coupon and risk characteristics, in effect matching the assets and liabilities. Pension plan expense, and payment of interest on bonds, generate tax savings to the employer, while gains to the pension plan accrue untaxed. If the funding is done with equity, no interest expense is generated, but a tax deduction can be gained by using an Employee Stock Ownership Plan. And even if its own shares can't be purchased for the pension plan, the employer can seek a portfolio of other shares with an overall match of expected return and risk, again generating a hedge with tax benefits.

However, we believe that the business of insuring persons should not rely on arbitrages provided by the tax code, but rather should concentrate on the ALM of personal balance sheet of customers. Taxes do represent expenses to individuals and intermediaries serving them, and they have a place in the overall cash flow picture. Yet the three main portions of the personal balance sheet management are:

- Diversifiable risks options (death, disability, and catastrophic expense).
- Derivatives used for the purpose of cash flow management (life insurance and annuities, car, home, property, liability, and health insurance).
- Nondiversifiable risk options (mostly interest rate options).

We have already mentioned that the management of nondiversifiable risk options provided to life insurance consumers appears to be a problem if viewed from the perspective of their personal balance sheet management. Customers appear to receive options they do not necessarily need. Should options that are of little value to consumers be provided to them? A historical problem for the life insurance industry has been underpricing the options embedded in policies. It would appear unnatural for such irrational behavior on the part of otherwise rational enterprises to persist. But consider the following hypothesis. Options required by the Standard Nonforfeiture Laws may not be demanded by the consumers. This weak demand, coupled with increasing competitiveness in the financial intermediation industry, could explain the pricing behavior of life insurance enterprises. The lesson for the insurance company is that the entire financial profile of the consumer should be a consideration.

Furthermore, consumers' preferences are not uniform. Insurers may do best by serving stratified groups of consumers. In fact, technology, which has been traditionally viewed as a device for lowering costs, is becoming a tool of competitive advantage by allowing

better crafting of the relationship between the product and the financial profile of the customer. If the industry keeps it firmly in mind that the mission is to address human capital cash flows in a way that addresses an individual consumer's profile (the actual balance sheet management of this actual person) the resulting competitive advantage could be powerful.

Because of institutional barriers, some portions of financial management of human capital traditionally have been excluded from life insurance domain. Consumer credit is a main area, including both consumption purchases and long-term durables and housing. Yet such products are often sold in bundles with insurance, such as credit insurance, or property insurance for the mortgaged property. The changing and competitive nature of modern financial intermediation has created a situation where various legal entities operate in areas previously dominated by other legal entities. Industrial enterprises such as General Electric and General Motors are major consumer lenders. Banks sell insurance in many European nations and, to a limited degree, in the United States. When viewed from the perspective of securitization of human capital, these legal barriers appear unnatural. Why would a consumer not use the same company to finance a home purchase and life insurance? If the objective is to align a consumer's cash flows, various other parties to those cash flows may indeed converge. This must be taken into account by insurance enterprises.

If we consider the wave of financial innovation that has swept over us the last three decades, a powerful parallel between the mission of insuring individuals and certain new securities emerges. Anthony Saunders (1994, chap. 21) defines securitization as the packaging and selling of loans and other assets backed by securities. It is a relatively new mechanism that financial intermediaries have used to make their portfolios more liquid, earn fee income, and help reduce the impact of regulatory burden such as capital requirement, reserve requirements (for banks), and deposit insurance premium (for banks). The major forms of asset securitization are the pass-through security, the collateralized mortgage obligation (CMO), and the asset-backed security. The more traditional securitization procedure used by banks has been direct loan sales.

Life insurance can be viewed as *securitization of human capital.* When financial intermediaries find themselves holding assets that do not fit their needs, or the structure of their liabilities, they can then either purchase different assets or restructure the existing assets. Banks historically have been large issuers of mortgages, car loans, and credit card debt. The amount of risk produced by combining these assets with the liabilities of relatively short-term deposits has proved itself often to be higher than that acceptable to banks' owners, managers, and regulators. During the 1980s, financial entrepreneurs responded to this opportunity by pooling mortgages, car loans, or even credit card receivables, and issuing certificates of participation in the cash flows of such pools. The greatest innovation has been a mortgage-backed security (MBS), and its sophisticated cousin, the collateralized mortgage obligation (CMO). While a simple MBS provides pro-rata share of cash flows of a mortgage pool, CMOs come in special classes (tranches) of cash flows specifically designed to produce cash flows of greater stability, or greater risk, in order to meet the needs of various purchasers of those securities better.

Similarly, human capital flows have risks beyond those acceptable to holders of those nonmarketable securities (the consumers), mostly because of human capital risks. Insurance companies offer pooling of portions of human capital cash flows in exchange for cash flows that better match the needs of the consumers. This may mean exchanging stable cash flows (premiums) for random payments (term life insurance, car insurance, major medical insurance, property and liability coverage), exchanging current flows for future flows (accumulation products), exchanging current outflows for future inflows (consumer credit), or exchanging completely predictable flows now for completely predictable flows now solely for the purpose of tax arbitrage (typical group health insurance coverage). In this securitization process, consumers repurchase their own human capital flow-throughs, generally with the most risky portion of the security retained by the insurer (interestingly enough, in the case of MBS, these portions retained by the insurers normally would be termed the *kitchen sink derivatives).* The mission of the insurer of individuals appears to be the creation of a better derivative built on human capital.

Let us look at an interesting perspective on one of the fundamental issues in human capital securitization: financial management of the ''tail end'' of human capital as a security. The negative cash flows at the end of a person's life must be financed. This is done either through a private or social insurance annuity, or through a portfolio of securities owned by that individual. Of course, an annuity is yet another example of a security owned by the individual and so is a social insurance annuity (yes, social insurance benefits are statutory, but tax statutes can similarly change the value of any security). The two approaches point out the standard dichotomy in approaching the problem of old age: Either the risk of outliving one's money is

eliminated, together with nondiversifiable market risks (with the possible exception of inflation risk), or both life extension risk and market risks are accepted by the individual.

This is partly remedied by the investment strategies recommended to aged individuals. Malkiel (1996) provides the standard recommendation: ''In retirement, [a] portfolio mainly in a variety of intermediate-term bonds (five to ten years to maturity) and long-term bonds (over ten years to maturity) is recommended. The small proportion of stocks is included to give some income growth to cope with inflation''(p. 418). Yet from the point of view of managing the personal balance sheet of consumers, it would appear to be more appropriate to manage their assets and liabilities in tandem, instead of seeking elimination of asset loss (C-1) risk, as suggested by Malkiel (1996). Note that traditional annuity and life insurance business has been increasingly forced to compete with variable annuities that offer fewer nondiversifiable (market) risk options, while still preserving some degree of protection against human capital risks. From the ALM perspective, at retirement, an individual should hold an asset that will provide the best degree of consistency with the projected liabilities cash flow. This, of course, must be combined with profit maximization of the provider of such an asset. The competitive pressure experienced by the life annuity industry may represent a trend toward that ideal equilibrium.

An approach resembling the one proposed here is shown in a model developed by Milevsky, Robinson, and Ho (1994). The assumptions of the model are as follows. At retirement, the retiring investor possesses wealth $W_{0,}$ which she deposits into an account that allows her to allocate funds within various asset categories, at specified fixed points in time. Furthermore, at fixed points in time, she withdraws fixed sums from the account, pro rata from all asset categories, as long as there is sufficient balance in the account to cover the withdrawals.

Assume first that the interest rate earned in the investment account is deterministic. Let each year be divided into k period of equal length, with interest compounded at the end of each period, and consumption withdrawals coinciding with compounding. Denote by r the effective annual interest rate. At the end of the first period of length $1/k$, the investor's wealth is

$$W_1 = \max\left(0, \left(W_0(1 + r)^{1/k} - \frac{C}{k}\right)\right). \quad (4.1)$$

In this model, the balance of the account is not allowed to become negative. As the process of compounding and withdrawing is continued, the investor's wealth at the end of period n is:

$$W_n = \max\left(0, \left(\left(\ldots\left(\left(W_0(1 + r)^{1/k} - \frac{C}{k}\right)(1 + r)^{1/k} - \frac{C}{k}\right)\ldots\right)(1 + r)^{1/k} - \frac{C}{k}\right)\right) =$$

$$W_n = \max\left(0, \left(W_0(1 + r)^{n/k} - \frac{C}{k}\right)\left(\sum_{i=0}^{n-1}(1 + r)^{i/k}\right)\right) =$$

$$W_n = \max\left(0, \left(W_0(1 + r)^{n/k} - \frac{C}{k}\right)\left(\frac{(1 + r)^{n/k} - 1}{(1 + r)^{1/k} - 1}\right)\right). \quad (4.2)$$

The exact time of ''outliving one's money'' occurs, therefore, at the end of the period N^* such that

$$W_0(1 + r)^{N^*/k} = \frac{C}{k}\left(\frac{(1 + r)^{N^*/k} - 1}{(1 + r)^{1/k} - 1}\right), \quad (4.3)$$

that is, the accumulated value of the consumption annuity equals the accumulated value of the initial wealth. Equation (4.3) can be solved for N^*, with the result being

$$N^* = \left\lceil \frac{\ln(C) - \ln(C - kW_0((1 + r)^{1/k} - 1))}{\frac{1}{k}\ln(1 + r)} \right\rceil, \quad (4.4)$$

where the symbol $\lceil\ \rceil$ indicates the greatest integer function, i.e., the function that assigns to a number the greatest integer that is less than or equal to that number. This, of course, assumes that the consumption annuity is certain, that is, the retiree does not die before exhausting capital. If we incorporate mortality into the model, then we are interested in minimizing the probability

$${}_{N^*/k}p_x = \Pr((x) \text{ will survive to age } x + N^*/k). \quad (4.5)$$

Let us now incorporate the randomness of rates of return on the investment portfolio. Assume that the investor has a choice of m asset categories, and that

$$\vec{\alpha} = (\alpha_1, \alpha_2, \ldots, \alpha_m) \quad (4.6)$$

is the vector of asset allocation proportions. In the Milevsky, Robinson and Ho (1994) model, this allo-

cation is fixed throughout the life of the investor. The rates of return in a time period of length $1/k$ of the asset categories are assumed to have a multivariate lognormal distribution (Crow and Shimizu 1985) with annualized parameters

$\vec{M} = (\mu_1, \ldots, \mu_m)$
(vector of mean annual logarithmic returns),

$\Sigma = [\sigma_{ij}]_{1 \le i,j \le m}$
(variance-covariance matrix of annual logarithmic returns).

Of course, one can analyze other types of processes for rates of return. Let us denote by I_i the m-dimensional vector with all but i-th entry equal to zero, and the i-th entry equal to 1. Let I_i^T be its transpose. Let Λ be a value of the multivariate lognormal distribution (dependent on its parameters). Then the realized one-period return on the asset portfolio is the random variable

$$R^k(\vec{\alpha}) = \sum_{i=1}^{m} \alpha_i \Lambda \left(I_i \frac{1}{k} \mu, I_i \frac{1}{k} \Sigma I_i^T \right). \qquad (4.7)$$

A subscript of the random variable defined in Equation (4.7) will show what the period's realized return is. At the end of the n-th period, the wealth of the investor is now a random variable

$$W_n = \max\left(0, \left(\left(\ldots\left(\left(W_0(1 + R^k(\vec{\alpha})_1) - \frac{C}{k}\right)(1 + R^k(\vec{\alpha})_2) - \frac{C}{k}\right)\ldots\right)(1 + R^k(\vec{\alpha})_n) - \frac{C}{k}\right)\right) =$$
$$= W_n = \max\left(0, \left(W_0 \prod_{i=1}^{n}(1 + R^k(\vec{\alpha})_i) - \frac{C}{k}\right)\left(\sum_{i=0}^{n-1}\prod_{j=1}^{i}(1 + R^k(\vec{\alpha})_j)\right)\right). \qquad (4.8)$$

Now N^* is defined as *first exit time* of the stochastic process W_n from the set of positive numbers. That is,

$$N^* = \min\{n \in N : W_n = 0\}. \qquad (4.9)$$

If we assume independence of wealth and mortality, then the probability that one outlives one's money will then equal

$$\sum_{i=1}^{+\infty} {}_{\frac{1}{k}}p_x \Pr(N^* = i). \qquad (4.10)$$

Milevsky, Robinson, and Ho (1994) perform numerical calculations in which they estimate the value (4.10) under assumption of lognormality of returns and return data from Hatch and White (1988), as well as using mortality data provided by Statistics Canada. The method of numerical estimation was the standard Monte Carlo simulation. The conclusions of the three authors indicate several interesting phenomena of great importance to designers of securitized human capital:

- Retirees should consider their desired consumption, existing wealth, age, and gender (or, more generally, mortality) before deciding how to allocate their portfolios.
- In most cases, allocation to higher risk/higher return assets should be higher than the traditional recommendations of financial planners.
- Persons with higher life expectancy (e.g., women) should allocate higher proportion of their portfolio to assets with higher systematic risk.

In particular, the simulations of Milevsky, Robinson, and Ho (1994) indicate the following findings for a person who retires at age 55 with accumulated wealth of $1 million and intends to consume $40,000 a year:

- The optimal allocation to equities for a male is 55%, with 3.94% probability of outliving assets.
- The optimal allocation to equities for a female is 75%, with 6.81% probability of outliving assets.

We cannot possibly expect the customers of life insurance firms to perform similar simulations. Yet, it is perfectly clear that *only* life insurance firms are currently equipped and capable of developing models for such optimal portfolio constructions for their customers. This is a unique historical opportunity where the crafting of a human capital derivative can be greatly enhanced by utilizing modern technology and financial engineering. And, of course, if the life insurance industry does not do this job, somebody else will.

Ironically, new regulatory requirements for cash flow testing and dynamic solvency testing, and new technologies developed to meet them, might give the life insurance industry a new competitive advantage: dynamic modeling of not themselves, but their clients, and finding innovative ways to restructure clients cash flows. In other words, they could securitize them into three sets of packages: securities sold back to clients, those kept by insurance firms, and those resold to other investors. This will eventually include issuance of securities backed by various premium receivables and trading of catastrophic losses futures (losses can be derived from natural catastrophes, such as hurricanes, but also from catastrophic medical expenses or liabilities).