Is Life Insurance a Human Capital Derivatives Business?

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Abstract: Life and disability insurance, as well as annuities, traditionally have been analyzed as products providing protection against random losses. This article proposes that these products can be viewed as derivative instruments created to address the uncertainties and inadequacies of an individual's human capital, if human capital is viewed as a financial instrument. In short, life insurance (including disability insurance and annuities) is the business of human capital securitization. *Keywords:* human capital, securitization, life insurance, background risks.

F inancial intermediaries such as banks, mutual fund companies, and insurance companies are in a business that is unlike any other. Instead of being directly a part of nation's commerce, they "grease the wheels of commerce." They stand between the "saving sector" of the economy, providing the supply of funds and a demand for securities, and the "producing sector," which creates the demand for funds and a supply of securities. The role of intermediaries is needed because securities supplied by the productive sector are not the ones demanded by the savers; the securities either are too risky (for the purchasers—i.e., the savers) or do not hedge the risks of funds providers (for the insured, also exchanging their savings for the products). One implication of the intermediation perspec-

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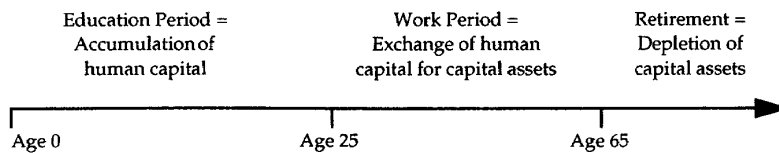
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tive on insurance is that in order to understand the business, we should understand not only the insurance firm's cash flows, but the cash flows of its customers.

In this article, I focus on individual demand for insurance. It is widely understood (Black and Skipper, 2000) that the business of life insurance is very closely related to the life cycle of income and expenditures of individuals. Death protection generally is the overwhelming concern in the early years of adult life, 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 life stages give rise to the various forms of the traditional life insurance business, which provide protection against untimely death—or untimely life.

Chalke (1996) states that insurance purchased by individuals is instrumental in helping consumers align their personal balance sheets. Beyond capital assets, consumers possess only one other source of income: *human capital*. Human capital is defined (Gwartney and Stroup, 1995) as the education and skills acquired by a person in order to produce future employment income. But such income does not match the liability stream of its owner. First, it requires an initial investment in education. Then, starting with initial employment, the individual's income generally rises over time, levelling between ages 50 and 60 and dropping at retirement. Therefore, when both human capital and expenses of a 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 three major periods:

- Education (i.e., creation of human capital), typically 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.

If we assume that the ages dividing an individual's life into three periods are 25 and 65, we get the following time line of human capital:

Education Period = Accumulation of human capital	Work Period = Exchange of human capital for capital assets	Retirement = Depletion of capital assets

Age 0   Age 25   Age 65

There is also, of course, the death risk, which creates a negative cash flow not for the individual, but for his or her household.

The challenge of life insurance lies in the personal balance sheet asset-liability management. This management includes not only financing the combination of negative and positive cash flows, creating options that individuals need for their balance sheets. Individuals face the background risks of death and disability, both causing dramatic decreases in the value of their human capital that cannot be diversified by them, but can be diversified by firms insuring them. As a result, the main function of insurance is not exactly to diversify (as insured individuals would assume), but to integrate the cash flows of assets and liabilities of diversified pools of individuals. This integration can be represented by the following sub-functions (Chalke, 1996):

- Pure insurance: term life insurance; disability, health, automobile, home, and liability insurance;

- 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 difference between the two is not necessarily as pure as presented by Chalke. The pure insurance products also are derivatives. Let us illustrate this point with some examples. The consumer's economic balance sheet can be presented as follows:

- Assets
  - Human capital (present value of future earnings stream)
  - Accumulated real assets (e.g., home, cars) and financial assets (e.g., pensions, savings, investments)
  - 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
  - Debt issued (mortgages—e.g., home mortgages and car loans; and debentures—i.e., credit card debt and personal lines of credit outstanding)

We have not included any derivatives written by individuals. While it is quite rare for individuals to write options of any kind, it is common for individuals to hold options. The most obvious example in the United States

is the widely held option to prepay one's home mortgage or car loan, as well as the option to pay off credit card balances.

But 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 risks that are not related to the risks of financial markets, which could be termed background risks (Franke, Stapleton, and Subrahmanyam, 1994, utilize this concept, referring to those risks faced by an entity, which cannot be traded in any market; the concept is also dicussed by Ostaszewski, 2002). Economic decision makers who are subject to such non-marketable background risks naturally would tend to be purchasers of options. According to the *short-straddle model*, it is well known that insurers tend to be interest rate option writers to the public (which faces background risks of human capital) and to the corporate industrial sector (which faces the industry-specific risks, usually related to taxes, bankruptcy cost, and agency problems; see Mayers and Smith, 1982). But life, health, and disability insurance products effectively offer options on the net position:

HUMAN CAPITAL—HUMAN CAPITAL EXPENSES

Consider the following. Let human capital expenses equal 25 percent of human capital income. Let a disability insurance policy provide 60 percent 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 percent of its initial value, the insured has an incentive to effectively put his/her human capital to the insurance company in exchange for the exercise price of 60 percent of original human capital value. Of course, the policy must provide specific conditions that would allow the exercise of the put option. Such conditions generally set the strike price to be at 0 percent (i.e., when human capital becomes worthless, the put can be exercised—note that this effectively creates a put that is exercised at a price different from its strike price; these types of options are rare in cases of options on capital assets, but for human capital they are an efficient way to address moral hazard). We should note that if rehabilitation (i.e., return to work because of recovery of human capital earning power) is a possibility in the contract, the delivery of the human capital to the insurance company is real. Furthermore, the insurance company that at disability is short an annuity to the insured retains a call on that annuity should rehabilitation prove successful.

In the case of term life insurance, there is a put on human capital, with the exercise price being the amount of insurance and the strike price being

zero (no chance of rehabilitation here, although cryonic suspension services are offered by at least three U.S.-based companies).

The natural question is: Why do existing life insurance products recognize the link between human capital and the amount of insurance only to a limited degree? Life companies do expect insurable interest when the contract is purchased, but do not insist on it subsequently, and do not seek to establish at least approximate relationship between the value of human capital and the amount of life insurance purchased. Several implications of this model can be pointed out immediately.

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

Second, the value of human capital is highly uncertain and depends on an individual's efforts to increase his education and skills. However, it is quite clear that for diversified groups of individuals, the maximum value of human capital (on a 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 option (i.e., insurance amount) to be reduced 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.

Let us illustrate this idea. Assume a hypothetical person starts with no debt and with salary and expenses of $20,000 per year at age 22. Also assume a 3 percent real rate in salary increases from age 22 (college graduation) through age 40, then ten years of growth of 4 percent, followed by ten years of growth of 2 percent, and finally 1 percent growth through retirement at 65, with expenses growing at 1 percent before age 60 and 3 percent thereafter (because of medical expenses). Figure 1 shows lifetime cash flows for an average individual in a diversified group (i.e., we ignore the death and/or disability options).

Figure 1 (which resembles a similar idea of Chalke, 1996) clearly illustrates the mismatch of asset and liability cash flows of a typical individual consumer. If we add the need for catastrophic-type options on human capital (death, disability) or on real assets acquired (catastrophic property damage), individuals' need for restructuring their cash flows is apparent. Let us add here one more observation. 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,
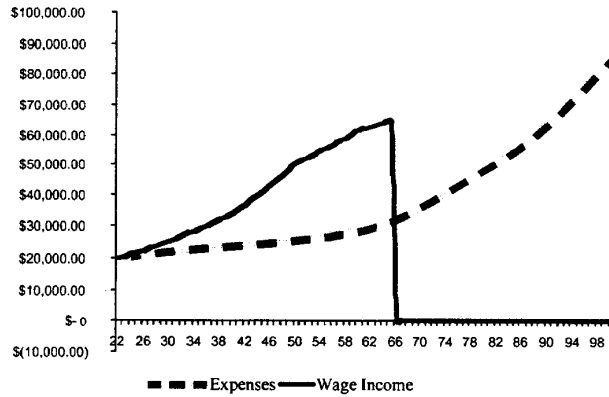
Fig. 1. Lifetime cash flows of an average individual.

discount actuarially (that is, discount with consideration for interest and mortality) using the Illustrative Life Table of Bowers et al. (1997), and assume no savings on the part of individuals, the resulting human capital line is shown in Figure 2.

We see that individuals face a rapid decline of their human capital, all the way to negative values, near 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 in the mid-forties and is followed by rapid decline. Now, if we change the cash flow stream by
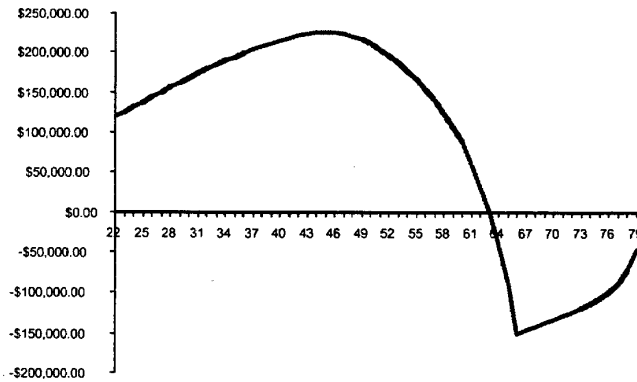
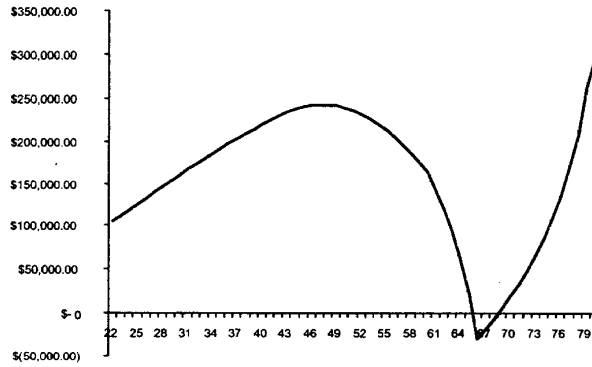Fig. 2. The value of human capital (savings rate = 0 percent).

Fig. 3. The value of human capital (savings rate = 3%, assumed real investment return = 3 percent).

introducing a permanent 3 percent savings rate (of gross income), invested at 3 percent, we arrive at the graph of human capital value presented in Figure 3. Note that while the y-axes on these graphs are not of the same scale, they are of significantly different ranges, and thus using the same scale would produce graphs of dramatically different sizes.

Similarly, a 10 percent savings rate produces the graph of human capital value in relation to age in Figure 4. We see that the 10 percent savings rate results in human capital value always remaining positive under our assumptions.
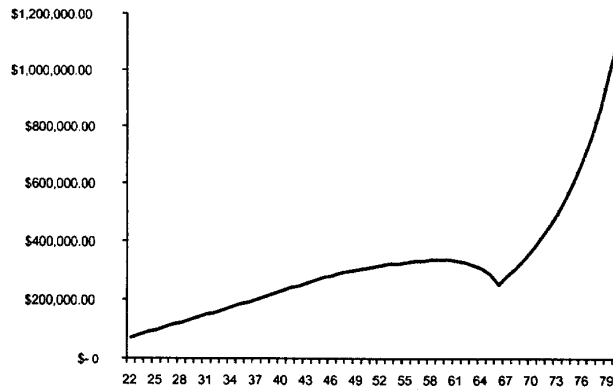

Fig. 4. The value of human capital (savings rate = 10 percent, assumed real investment return = 3 percent).
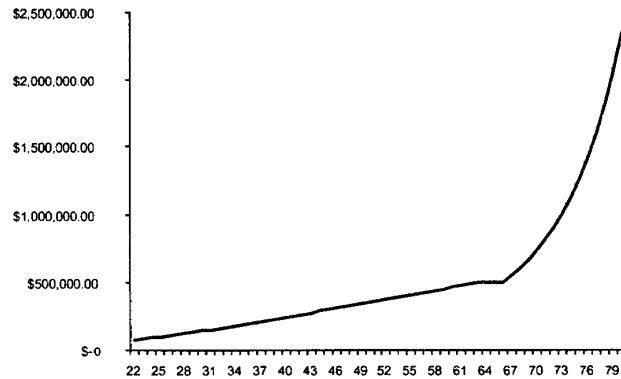
Fig. 5. The value of human capital (savings rate = 10 percent, assumed real investment return = 5 percent).

The savings rate as high as 10 percent seems unreasonable in the United States, given the low U.S. savings rate (although the actual economic rate may be higher than the official statistics, owing to capital gains in assets held by the public, especially real estate), 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 do arrive at a number much closer to such a rate as reasonable.

The rate of return of 3 percent (effectively the real rate, for the sake of our example) may seem low, and we provide an illustration of real rate of return of 5 percent and the 10 percent savings rate in Figure 5. This higher rate of return, combined with a 10 percent savings rate, causes the combined human and financial capital to be non-decreasing.

We see therefore that in addition to providing options related to non-diversifiable background risks related to human capital—i.e., death, disability, and catastrophic expense options—the main function of life insurers 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 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 sheets.

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 effectively is the right to call the existing mortgage (a note issued by the consumer).

Thus, consumers who own homes and also purchase annuities and life insurance products often find themselves holding the same option twice. This also means that, in competitive market, they will *pay* for the same option twice. The strict regimen of the Standard Nonforfeiture Law minimum interest rate guarantee coupled with the predominance of callable (prepayable) mortgages may not necessarily be the best prescription for consumers. Similarly, interest rates credited on traditional fixed annuities following an index such as a five-year constant maturity Treasury yield coupled with holding a fixed-rate long-term mortgage on a house results in being hedged against rising interest rates twice.

A young couple with children may indeed be better off purchasing a term life insurance policy than paying for the refinancing option in the higher mortgage cost. In both cases, the consumers purchase options that benefit them when interest rates fall, either in the form of the minimum interest rate guarantee or in the form of the mortgage prepayment option. Why buy two similar hedges simultaneously? It should be noted that in most countries around 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, being already partially hedged against falling interest rates through his 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. The tax structure may result in 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 personal balance sheet asset-liability management. On the other hand, taxes may offer unique arbitrage opportunities that may provide new markets for the industry. The classical arbitrage in this context 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 complicated further in the case of pension plans. If an employer issues bonds and uses proceeds to fund a pension plan for her employees, she is generally prevented from purchasing her own bonds in

the pension plan (in the United States, that would represent a violation of the 1974 Employee Retirement Income Security Act). However, she can purchase a portfolio of bonds with similar coupon and risk characteristics, in effect matching the assets and liabilities. Pension plan expenses and interest payments 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 the firm's own shares can't be purchased for the pension plan, one can seek a portfolio of other companies' shares with an overall match of expected return and risk, again generating a hedge with tax benefits.

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

- Diversifiable risks options (death, disability, and catastrophic expense);

- Non-diversifiable risk options (mostly interest rate options);

- Derivatives used for the purpose of cash flow management (life insurance and annuities, car, home, property, liability, and health insurance).

We already have mentioned that the management of non-diversifiable risk options provided to life insurance consumers appears to be a problem if viewed from the perspective of their personal balance-sheet management. As discussed earlier, 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 of options embedded in liabilities and assets (Smith, 1982, expresses a life insurance policy as a package of options; see also Babbel and Merrill, 1996; Ostaszewski, 2002, especially the Short Straddle Model; and a strong comment on the asset side of the issue by Babbel, 1993). It would appear unnatural for such irrational behavior on the part of otherwise rational enterprises to persist. But if we allow ourselves to consider the hypothesis that options required by the Standard Nonforfeiture Laws may not be demanded by consumers, this weak demand, coupled with increasing competitiveness of the financial intermediation industry, may indeed be the factor explaining 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, and that derivatives offered to customers should be the ones that fit their human and financial capital portfolio.

Moreover, consumers' preferences are not uniform. Insurers may do best by serving stratified groups of consumers. In fact, modern computing technology, which traditionally has been viewed as a device for lowering costs, is becoming a tool of competitive advantage, by allowing better crafting of the relationship of 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 ways that addresses the individual consumer's profile—the actual balance-sheet management of this actual person—the resulting competitive advantage may be powerful. Note that life insurance companies are uniquely qualified to offer stratified or even personalized products, such as annuities indexed to cost of living specific to a consumer, if they fully utilize existing technology.

Because of institutional barriers, some portions of financial management of human capital traditionally have been excluded from the domain of life insurers. Consumer credit is the main such area, including both consumption purchases and long-term durables as well as housing. Yet such products often are 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 in which 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. The process of integration of financial institutions has been streamlined in the United States by the Gramm-Leach-Bliley Act of 1999, which, among other things, allows insurance companies to own and operate banks (see the discussion of this process by Schellhorn and Scordis, 2002). Why would a consumer not use the same company to finance a home purchase and to finance life insurance? If the objective is to align consumers' cash flows, various other parties to those cash flows may indeed converge. Insurers must remember that this convergence of needs is a unique source of competitive advantage for them. Nobody else in the financial intermediation marketplace is now capable of structuring financial instruments based on human capital, as mortality, disability, health, disaster, and other insurable risks play such a major role in the actual value of human capital. Only insurers have the infrastructure in place to be able to create and price derivative securities based on human capital. When the baby boomers attempt to retire without having saved much during their

working careers, those financial institutions that can provide them with optimal annuity payouts (see, e.g., Milevsky, Robinson, and Ho, 1994) will suddenly acquire new importance and prominence—if, of course, if the insurers are ready for the new opportunity.

If we consider the wave of financial innovation that has occurred over the last three decades, a powerful parallel between the mission of insuring individuals and certain new securities emerges. Anthony Saunders (1994, Chapter 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 burdens such as capital requirements, reserve requirements (for banks), and deposit insurance premiums (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 may indeed 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 to be often higher than what was acceptable to banks' owners, managers, and regulators. During the 1980s, financial entrepreneurs responded to this opportunity by pooling mortgages, or car loans, or even credit card receivables, and issuers' certificates of participation in the cash flows of such pools. The greatest innovation has been a mortgage-backed security (MBS), and its sophisticated cousin: 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 better meet the needs of various purchasers of those securities.

Similarly, human capital flows have risks beyond those acceptable to holders of those non-marketable securities (the consumers), mostly because of human capital risks. Insurance companies offer pooling of portions of those human capital cash flows in exchange for cash flows that better match the needs of consumers. That may mean exchanging stable cash flows (premiums) for random payments (term life insurance, car insurance, major medical insurance, property and liability coverage), or exchanging current flows for future flows (accumulation products), or 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 would be normally termed the *kitchen sink derivatives*). The mission of the insurer of individuals appears to be the creation of a better derivative built upon human capital.

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