Risk in Investment Accumulation Products of Financial Institutions

Steven Craighead
Nationwide Life Insurance Company

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1 Introduction

Investment Accumulation Products currently account for the majority of the new premium for life insurance companies, as well as for banks and mutual funds. These relatively new contracts expose the financial institutions to several different risk management issues, some of which are: return guarantees, long-term options, disintermediation, market discontinuity, contractholder behavior, distribution channel behavior and practical administration.

First a definition (borrowing from Donna Claire [2]):

An Investment Accumulation Product (IAP) is a contract designed to accumulate funds with the intention of making payments at some future date primarily as a retirement income-funding vehicle. These products may either be funded by a single payment into the product or by payments made over time, either according to a fixed schedule or amounts at the option of the contractholder. Examples of such contracts include mutual funds, bank CDs, and fixed and variable annuities. (Note: There will be various tax considerations for these products based on the financial institution selling the product).

There are many questions to be considered with IAPs, some related to modeling, management, financial risks, and market psychology, which we hope to address within the following sections. Sections 3 through 7 are: "Financial Market Risks: Discontinuities or Catastrophes?", "Effects of Distribution Channels on Policyholder Behavior/Persistency", "Long-term Liabilities, Options and Guarantees", "Transfer Risk Modeling", and "Practical Aspects of Managing Annuity Blocks of Business."

However, in Section 2, we must touch on a preliminary issue before considering the remaining topics. Here we will discuss the requirements of choosing an economic scenario generator. We believe that discussions of the subsequent quantification and management of IAP risks are heavily dependent on having a proper perspective of economic scenario generation.

2 A Basic Requirement-Economic Scenario Generation[1]

In the sections that follow, we will examine certain issues concerning business models of IAP. These products have many complex and economically sensitive features. To understand the behavior of the related business models one must step back and have an understanding of the behavior of the economic scenarios that drive the output of these models. The results and credibility of the business model depend intimately on the economic scenario generator. If the economic scenarios have unrealistic economic behavior, one will obtain results that tend to be at least as unrealistic. The output of the business model determines what properties of an economic scenario generator are critical to your model's accuracy and usefulness. To gain the most understanding from our business models, we need the best starting point for the economic scenario generator, in terms of representing both the possible paths and their corresponding probabilities.

We know that there are still issues we have to understand even with the best economic scenario generators. In addition if we do not start with one that is as good as possible, then the work needed to understand the business results is impossibly difficult. It is still difficult even with a good generator.

We also admit that in reality, we are applying business models under real world constraints and limited resources; we do not have the time to do more than just apply the generator and do some sensitivity analysis. However, if our understanding of our business models is tied to our concept of the performance of the economy, we still need to have the best generator with the best calibration at hand. This is especially true if we have insufficent time to understand what in the generator is driving the business results, or to take action even if we do understand.

We need certain guidelines that help in understanding the basic characteristics of the generator. These guidelines, known as "razors" (after Occam's Razor) or qualitative "stylized facts", describe certain requirements that the economic scenario generator must fulfill. For example, any economic scenario generator must produce interest rates that do not go negative, or go to infinity.

[1]This following section is based on Mark Tenney's talk "State of the Art in Applying Economic Scenario Generators in the Life Insurance Business in the U.S." at the 1998 Valuation Actuary Symposium at Orlando, Florida.

Also, there are certain quantitative stylized facts that are historically observed statistics, which may change as new events occur in the economy. These statistics should be incorporated into the model to ensure that the model does not deviate too far from historical observations. For example, it would not be desirable for the model to develop inverted yields curves 50% of the time, when in the past 44 years U.S. Treasury yield curves were inverted about 15% of the time.

Besides these stylized facts, what goes into the best generators at the current time?

1. The generator should be arbitrage free. If not, then there are inconsistant relationships within the generator. If the generator already contains logical inconsistencies, it would be perilous to construct stylized facts for the generator. Note that the arbitrage free condition does not preclude the model from producing a more historical or realistic evolution of states.

2. The generator must have a logical structure that is consistent with respect to understanding the history of interest rates and macro-economic behavior over long time periods. This structure allows us to understand the activity of economic agents in the context of the model. These agents include the Federal Reserve, investors, life insurance companies, fund houses and banks. The model should allow us analyze the economy and apply our ideas about the behavior of these economic agents in analyzing the scenarios. If the model is a mishmash of model components that do not correspond very well, we cannot get far in calibrating the model with respect to important business decisions. In addition, we are hampered in our ability to develop stylized facts for the links between the generator structure, the calibration, and the business results.

3. The generator should model all relevant economic indices such as inflation, stock total return, dividend indices, etc. When these indices are included in the scenario generator, more extensive stylized facts should be collected (while also considering any correlation between these stylized facts) and additional calibrations need to be conducted.

4. The design of the economic scenario generator should be fairly modular so that one can add additional indices or factors as needed. One does

hope, however, that additional factors do not supercede the earlier factors. In any event, any interrelationships between economic factors can complicate the addition of factors to generators. For example, suppose one has an an economic scenario generator for the U.S. economy and a separate generator for the Canadian economy. If these generators are designed to be fairly modular, the two systems could be merged with only consideration of the exchange rate between the two economies.

Good economic scenario generation is difficult and time consuming. However, it is critical in modeling the risks discussed in the following sections.

3 Financial Market Risks: Discontinuities or Catastrophes?

The insurance and mutual fund industries face the risk of catastrophic market failures. Investment strategies are formulated to produce meaningful results in terms of expected returns and levels of risk. Strategies and new products are often formulated to work over long periods of time and are tested using both historic data and stochastic simulations. Yet, rarely is a truly disastrous event included in the simulation. Additionally, most finance theories in practice today assume that the movement of prices of financial instruments follows some smooth mathematical function. Even in well-developed markets such as equities and commodities, price jumps are not uncommon. Consequently, most asset models fail to capture risks associated with discontinuities in asset prices and systematic market risk.

The major concern with the discontinuity of markets is the risk of insolvency. Regulation has attempted to address this by requiring additional reserves and guarantee funds for the insurance industry, and risk based capital requirements for both the insurance and banking industries. Also, occasionally the government will bail out a troubled company to reduce systematic risk and prevent major repercussions in the economy. These insolvency requirements and the occasional assistance place the industry in a balancing act between understanding how far to protect themselves from insolvency and how much they can rely on the government in an economic crisis. The first problem for the industry is to determine their responsibility for insolvency due to these extreme events. This I believe is fundamental and will

influence all subsequent issues and problems associated with a discontinuous economy.

Currently, most of our models assume a finite volatility. Dr. Mandelbrot [10] observed that when one finitely samples a distribution that has nonexistent variance, the sample variance will continuously vary. Since most of the observed market indices have continuous changing volatility, he suggested the use of models such as Fractional Brownian Motion or Stable Levy Processes to model these indices.

One thing these infinite variance models reveal is that there is no effective way to set up sufficient reserves to cover all potential situations. An example of this was produced when I used a Fractional Brownian motion [3, 6, 11, 12, 13, 14] process in 1994 to generate economic scenarios to estimate the value of Nationwide Life Insurance Company's position from the minimum death benefit guarantees on their variable fund products. In a high percentage of the scenarios modeled by this process produced equity values similar to a stock market crash with little or no recovery. When using these scenarios to calculate the necessary reserves on these contract guarantees, the reserves produced were four or five times greater than the reserves produced by a simple lognormal process. This explosive difference of reserves also corresponds to Klein's results [8] when he determined the necessary reserves on a SPDA product when modeling interest rates as a Stable Levy process versus a log-normal process. (A side note: Fractional Brownian motion cannot be used to model the term structure of interest rates because it introduces an instantaneous arbitrage [4]).

Conducting these extreme types of tests is very instructive, but the results tend to be regarded skeptically by upper management, perhaps due in large measure to the fact that the results can be very different from what they've seen previously. In fact, if an insurance company establishes reserves at the magnitude suggested by the studies, the high capital cost of certain floor guarantees could indicate that the company should discontinue issuing them. This is an example of the impossibility of separating the modeling of business problem from that of modeling the economic scenario generator, as discussed in the first section.

So, how do we get to models that are useful? It appears that at least part of answer will depend on the following:

1. How does one properly account for discontinuities in these models?

2. How should the modeler conduct historical analysis to determine the percentage of discontinuous events?

3. How does the modeler observe the position of the economy at the time of these discontinuities and properly inject the economic mechanics into his or her model?

4. How much of the data should be considered as outliers in the calibration of the model? Should the modeler take a holistic approach and assume that the model must consider the behavior of the entire historical data record or should there be pruning of outliers?

5. Can one use a discrete model (such as a Poisson Jump Process) that models jump processes but in the limit approaches known continuous models? See [7] for a discussion of this type of model.

6. Can one apply extreme value statistics? Can one consider the setting aside of reserves and/or surplus to be analogous to that of building a dike or a levee? Hydrological engineers do not try to remove all possible risk. Instead they design dikes or levees to withstand a 1 in 100-year event (or 1 in 500-, 1 in 1,000-, or even a 1 in 10,000-year event!). See [5] for a further discussion of these topics.

7. How difficult is it to understand the probabilistic uncertainty within the model? Can one create hedges against this uncertainty?

8. What is the statistical uncertainty that the modeler takes on when he or she designs a specific model? Can one create hedges against this uncertainty?

9. Is there a simple way to manage these risks, without resorting to complex models? Could one set up event reserves once a discontinuity has occurred? Could this be done in a fashion similar to disability claims reserves? How would these reserves be released? What is the impact on the shareholders if these reserves are set up (e.g., what are the GAAP effects)? What impact will the rating agencies have on the company if the company would set up these types of reserves? Can there be any tax advantage if these reserves are set up?

10. What type of monitoring system should be setup within a company or within the financial industry to recognize and understand these risks?

11. How does a company construct strategies to respond to these types of events?

12. How can Behavioral Microeconomics influence the model design and company management during these discontinuities? Hopefully, Nino Boezio's research on the literature of Behavioral Microeconomics will give the necessary insight.

13. How does a company restructure their various asset positions efficiently when these events occur? How do these risks affect the asset and liability management of a company?

14. How does discontinuity risk influence affect counter-party risk?

15. Can a company "lay off" the risk (e.g. reinsurance)? This is dependent upon well one can diversify the risk in question is.

16. Can derivative instruments or other financial mechanisms (e.g. CAT bonds) be utilized?

As you can see there are many difficult problems associated with our understanding of market discontinuity risk. We can only hope that our work here will lay a solid foundation to begin to answer some of these questions and problems.

Next, let's look at retention as affected by the distribution channels in investment accumulation products.

4 Effects of Distribution Channels on Policyholder Behavior/Persistency

Risks to the insurance and mutual fund industry occur in the relationships between distribution system, compensation and product persistency. Such risks may be found in both the insurance industry and mutual fund industries.

Basic questions that need to be considered are:

1. What types of distribution channels are associated with the business?

2. Are they retail or wholesale, individual or group?

3. How does the contractholder obtain information before and after purchase? Is it directly from a sales representative or from the Internet, by mail, or by phone contact?

4. Are the products distributed or recommended by service professionals, such as insurance agents, stockbrokers, financial planners or bank employees?

5. How are these professionals organized, e.g. are the insurance agents captive or independent?

6. What type of compensation is available to the product distributor (e.g., commissions, service fees, 12b-1 fees, dividend reinvestment fees, redemption fees, wire redemption fees, exchange and other product specific fees)?

In addition it is important to understand the distribution-related risks which the company is exposed to. Some of these might be:

1. Mismarketing risk. An example of this would be where bank employees are selling variable annuities with a seven-year contingent deferred sales charge as seven-year certificates of deposit.

2. Churning of policies. Here the distribution channel will encourage the contractholder to convert to other products, so that the service professional will continue to obtain the higher initial commissions or fees.

3. Fraud. If a service professional receives commissions or fees based purely upon the volume of business, fraudulent contracts may be created just to meet the volume requirements.

4. Suitability risk. The distribution channel may not obtain key information about customers (such as date of birth) that may be critical to the suitability of the product(s) being developed or sold for the customers. Ignoring this can result in dissatisfied customers or product failures or both.

5. Separation risk. Service professionals can move from one company to another or change careers. This can lead to situations where the contractholder no longer has a service professional representing them with the company with the resultant potential for increased withdrawals or redemptions.

6. Preoccupation risk. Here the company is preoccupied with maintaining the distribution channel relationship at the cost of poor service to the contractholder.

7. Selection risk. Many service professionals or distribution entities may represent more than one company, creating the potential for a disproportionate number of sales of the company's least profitable products, markets or contractholder groups.

A look at possible methods to reduce these risks and improve retention is indicated. Some of these are:

1. Make sure product features promote customer or producer loyalty.

2. Improve and increase the services provided to give the company a competitive advantage.

3. Set up customer contact programs to develop relationships with the contractholder.

4. Make sure there is an accurate and consistent reporting system in place to monitor retention.

5. Contact contractholders that have left and determine their reasons for leaving.

6. Make use of periodic percentages of fund compensation to the distributing entities, or levelize commissions to reduce churning of policies. Here the compensation is paid upon retention of the contract.

7. Reduce compensation based on number of contract sold.

8. Use longer surrender charge periods.

9. Delay commission payments, apply "chargebacks" on early lapses or make them contingent upon retention.

10. Invest in the education of the service professionals. For example, equity-indexed annuities are being marketed by companies that may not have invested in the necessary education of their agents.

11. Continuously monitor the distribution process, especially where it involves contact with prospective and existing customers.

12. Avoid or minimize cross subsidization in product design.

13. Aggressively and consistently discipline illegal or unethical behavior.

14. Never sacrifice the customer's well being to the distribution process (or any other for that matter). To do otherwise is to put short-term tactics ahead of long term strategy.

15. Establish and enforce procedures that determine and ensure that products are suitable for the customers for which they are developed and sold to.

Other questions are:

1. How do you create models for retention?

2. How does the distribution channel-contractholder relationship change under different economic conditions?

3. How do you measure retention under partial withdrawals?

4. What are the critical features of Behavioral Microeconomics needed for these models?

5 Long-term Liabilities, Options and Guarantees

Risk to the insurance industry is associated with long-term liabilities, options and guarantees. IAP contracts of insurance companies often contain secondary guarantees that may become valuable in certain economic environments. Such guarantees include annuity purchase options with and without life contingencies, minimum rate guarantees, and allowances for additional premium payments. Also the long-term exposure to the company from disintermediation by the contractholder introduces a long-term put option at a book value strike price.

Since the models used to obtain the prices associated with the guarantees and long-term options are built on base economic models, at least two arise:

1. One must understand the economic conditions that create the highest exposure to the underlying risks with guarantees and long-term options. Looking back historically will give some perspective on the level of interest rates and the effect of inflation and other market factors.

2. One must create the theoretical underpinning for proper long-term term structure models and other economic models.

These long-term options and guarantees have been created by either regulatory control or by companies to improve market presence. Usually the regulatory requirement takes the higher priority in the proper pricing of the products. However some companies, to maintain a market presence, have implemented certain product guarantees (such as liberal minimum death benefit guarantees or high "floor" interest guarantees) without properly pricing the associated costs.

Other concerns that arise with constructing and using models, which recognize these guarantees or long-term options, are:

1. Designing and pricing of long-term options. With product guarantees such as minimum death benefits or with disintermediation, the company has sold an option to the contractholder that could be exercised well into the future. The difficulty is that the any corresponding asset derivative options a company might purchase to cover these options, may not be broadly traded or may have a prohibitive price. Another problem is that the price of shorter options may become higher in a highly volatile market, making the offset of these long product options by using a portfolio of shorter asset derivative options expensive.

2. Managing floor guarantees. How does a company obtain assets that cover high floor guarantees in a low interest rate market? How does a company reduce the chance of contractholders dumping extra funds into products with higher floor guarantees?

3. Managing market position. How does a company protect their market position in low interest rate and deflationary periods?

4. Protecting fees. How does a company protect their fees from products that are associated with fund values? If a company obtains their fees from a percentage of the funds, how do they cover fixed costs when there is a dramatic market drop?

5. Understanding contractholder behavior. What is the percentage of contractholders that will take advantage of the options embedded in their contracts? How does the company react if the inefficient market associated with their contractholders suddenly becomes efficient? Can we use Behavioral Microeconomics here and if so, how? ,

6 Transfer Risk Modeling

A special kind of risk associated with the long-term options and guarantees contained in many IAP is associated with the contractholder's right to transfer monies between various classes of assets and associated guarantees as specified in the contract. Variable fund products are often bundled with other fixed funds or lower risk variable fund products. This bundling widens the appeal of these products to the contractholder, but creates new risks for the associated company, such as book value vs. market value losses.

The understanding of transfer risk is complicated if a product is composed of both internally and externally managed funds. Here the company administers and invests funds internally as well as using externally administered funds such as mutual funds or invested equity "pools". This inter-company relationship is there to allow greater selection for the contractholder, and to improve the market penetration of the company. Inter-company risks includes the following:

1. Counter-party risk. This arises from insolvency of the external fund house, and if the company wraps book value guarantees around these external funds. Also, it potentially exposes the company to certain market risks that the other fund house has acquired.

2. Disintermediation risk. This arises if the external funds dramatically outperform the internal funds, and this result in a major movement from the internal fixed funds guaranteed at book value to external funds.

3. Expense risk. Frequent transfers cost the company more money. This can be remedied by limiting the number of transfers and by applying fee assessments.

4. Investment risk. If there is a large movement to funds with floor performance guarantees through transfers or new money, this can create

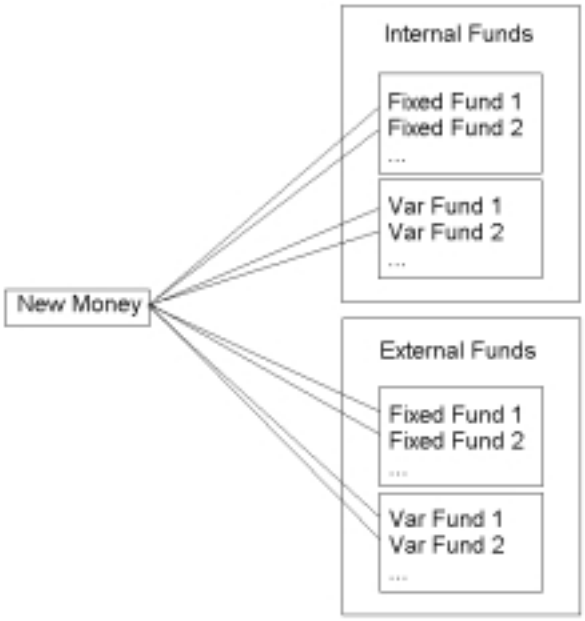

Figure 1: Allocation of New Money

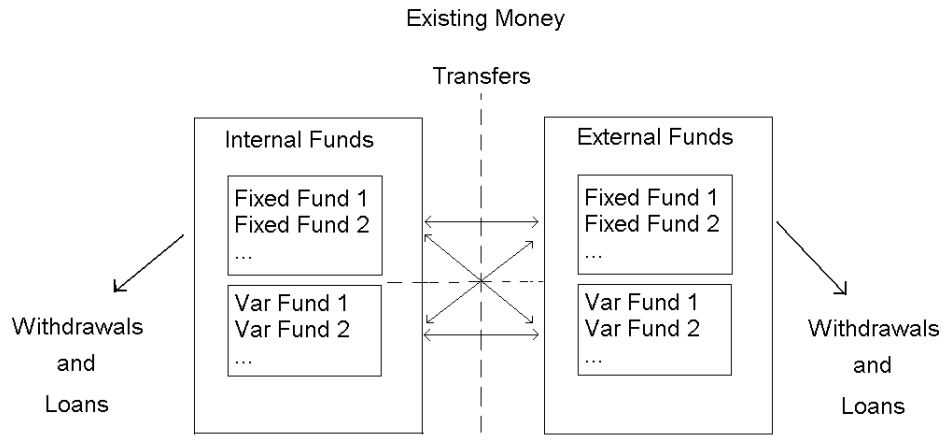

Figure 2: Possible Options for Reallocating Existing Funds(Restrictions on these may exist as denoted by the dashed lines)

difficulties. This can lower the portfolio rate if a company is crediting returns on all monies diluting the returns to existing funds. Also, it may be difficult to find assets that support the floor rates plus the pricing spreads without sacrificing asset quality and/or sound asset/liability management practices.

5. Large block movement risk. This should be considered with products where an influential broker can motivate the movement of large blocks of money.

6. Wrong decision risk. Some contractholders will exit the fund in low markets, thus "locking in" a lower return. This results in lower asset fees for the company.

The second concern to the company is the management of new money (see Figure 1) vs. existing money (see Figure 2). Some of the concerns here are:

1. Proper Treatment of Intergenerational Equity. First a company should not use the portfolio performance of the assets backing existing business to shore up the initial crediting rate to attract new business. Second is that if loans and/or withdrawals on the existing business are creating disintermediation, the company should be careful of acquiring risky new business to pay off the existing business resource drain.

2. Securitization risk. Here the company may securitize the fees obtained by the business, and if this securitization is based on the new money allocations and volume this can cause either extension risk or prepayment risk on these securities.

The model used to examine the potential risk of the company should include a contractholder behavior model, with the added complexity of allowing for possible fund movement. This model should allow for the following:

1. First do no harm. The design should be sensible, e. g. if modeled separate account performance drops, these funds should be subject to increased transfers and/or withdrawals.

2. Competitor's Crediting Strategy The model design must consider the influence of a competitor's crediting strategy. This can be as simple as a spread over Treasuries or as complex as desired.

3. Company's Crediting Strategy The model design must also consider how the company sets their crediting strategy. This of course will be used by the corporate model to model lapses and transfers.

4. Product Design The model must also consider major features of the product. In fact, control of transfers should be an integral design feature.

5. Distribution Channels The less direct influence a company has over a contractholder, the more a company must consider how the distribution channel influences transfers.

6. Occam's Razor. The design should be such that one is not measuring transfer risk with a micrometer when the only cutting tool available is an axe. For example, one should avoid complex option pricing techniques if certain assumptions (such as expenses) are barely justifiable. In fact, the remaining points within this enumerated list become ancillary to a good transfer model in the absence of hard data.

7. Determine potential impact of transfers. In product design there may be certain types of transfers that will actually increase a company's profit position. Here, one should attempt to understand and model this situation of the "good" vs. "bad" transfers.

8. Fund performance memory. The model may seek to consider previous years' performance of a specific fund with the other possible funds. This comparison should be on various internal, external and competitors fund performances.

9. Linkage to various economic conditions. One could consider bull vs. bear markets, high interest rates, inflation, recession and unemployment. Here, one should define the direction of transfer, type of fund and magnitude of transfer. For example, in a recession, and/or a period of high unemployment there will be an increase of loans and lapsation.

10. Base transfers. The model could assume that some "base" transfers and lapses would occur independent of the economy.

11. Burn out or inertia. The model might allow for the modeling of the fact that at a group of contractholders would completely disregard their

money's performance. This portion of contractholders is one major source of profit to the company. If securitization of liabilities become prominent within the industry, it is critical to be able to model contractholder inertia.

12. Demographic impact. The model might consider the large block of retiring baby boomers, borrowing needs of the contractholder for their children's college education, or any relevant contractholder attributes.

13. Run on the bank. The model probably should recognize the probability of sudden movements of funds out of a company if outside returns are materially in excess of those on the internal funds.

14. Consider that contact holders will do the wrong thing. This may be a result of things like the sophistication of the contractholders, distribution channels, inertia, bias or misunderstanding. An example of this would be the marketing of single premium deferred annuities as certificates of deposit in the bank channel. Here the contractholder is making elections that prevent a company from recovering their initial expenses.

There are several different possible model analogies or environments. Examination of some of the following should give direction in transfer modeling.

1. Health insurance. These forms of insurance require knowledge and insight considering how a contractholder will move between competitors and between plans with differing deductibles and out of pocket limits.

2. Long-term health care. Long-term health care modeling requires a solid insight in modeling the transitions of individuals between various states of increasing health care. The knowledge required to model this bi-directional movement between various levels of care could be of assistance in understanding various aspects of transfer models.

3. Mortality/lapse models. The mathematics required to estimate of the probability of transition between the different states in Figure 2, is a generalization of the mathematics to handle with mortality/lapse models. See [9]. A transfer model must be built up from a mortality/lapse model because of:

   (a) Mortality/lapse models are not bi-directional.

(b) There are fewer restrictions in the contracts only affected by mortality and lapse (e.g. "Thou shalt not die" just isn't in the contract).

(c) A transfer model would have more decrements and increment than a pure mortality/lapse model.

(d) There are more drivers (external and internal influences) on a transfer model.

4. Demographic migration models. Micro demographic migration models consider various external economic factors such as unemployment and recession. The modeling of these influences might give insight in transfer modeling.

5. Osmosis through a permeable membrane. Osmosis models consider

   (a) A base rate of osmosis.

   (b) The influence of various levels of pressure on either side of the membrane, in the rate of osmosis.

   (c) The possible rupture of the membrane. See [15].

6. Markov Chains. These models will allow the modeler to set up a transition matrix between various states of the system. It also allows the model designer to understand the ultimate steady state of the system.

7. Markov Chain Monte Carlo Methods. This allows the model designer to setup a hierarchical model, and determine the distributions associated with transitions between the different states. See [1].

Certain product design considerations and controls can be implemented to limit or control transfer risk as follows:

1. Limit the number of transfers. This should be tailored to the specific situation. As an example of how this may not be as simple as it looks in actual practice, we once had a group contract that consistently reached its limit of transfers within a given year. On closer examination, it happened that one specific member of the group had made all of these transfers. This individual transferred all of their money from the variable funds into fixed funds every Friday and back into variable funds on

Monday. The individual was doing this to allow for interest growth on their money when the market was closed! At next contract renewal we limited this behavior placing a transfer restriction at a member level as well as at a group level.

2. Limit the dollar amounts transferred as well as number of transfers.

3. Use transfer and/or surrender charges.

4. Use market value adjustments. This will reduce the risk of book value vs. market value loses due to the transfer between fixed and variable funds.

5. Limit the amount of partial withdrawals.

6. Control loan rates. One must analyze and understand any or all of the regulatory nuances associated with policy loans. With this knowledge, the company must be able to act quickly and responsibly to reduce or eliminate disintermediation due to increased loans.

7. Set administration charges on transfers. The determination of these charges will control the possible costs of movement of monies from internal funds to external funds.

8. Understand the distribution channel. Avoid commission structures that can create a distribution channel arbitrage. For example, if the product is distributed through bank channels, make sure that the product design of a product with a n-year surrender protection period is protected from being marketed as a n-year certificate of deposit which leads to possible large blocks of terminations.

9. Use derivatives. If the crediting rate for funds is externally indexed, derivatives could be designed to hedge against various external transfers.

10. Collect statistics on each fund. An average weighted time till retirement would be very useful. Another useful statistic is an average weighted time until the end of the surrender protection period.

11. Conduct sensitivity analysis. Examine how sensitive the business model is to various economic scenarios.

7 The Practical Aspects of Managing Annuity Blocks of Business[2]

The aspects of managing large blocks of variable annuity business or large mutual fund contracts leads to several practical problems that inhibit or even prevent the proper quantification and management of these blocks.

Risk to the insurance and mutual fund industry is associated with managing large annuity blocks of business. Despite a financial institution's best efforts to put in place the theoretical machinery to control investment risk in accumulation products, there are a number of real world, practical considerations which complicate the risk management.

In large fund or annuity blocks of business there are practical limitations of the automation of the administration. Some of these are:

1. System requirements.
   (a) Timely changes. The difficulty of making timely changes in the large (usually mainframe) administration systems is difficult at best. This problem has only increased due to the Year 2000 resource drain.
   (b) System auditing. Design and implementation of proper auditing procedures to check on things such as premium flow, surrenders, transfers, and reversals.
2. Policy Administration.
   (a) Limit on number of asset cells. The administration system may have originally allowed only a small set such as 50 or 100 funds to be administrated. This severely limits the ability to add new timely funds.
   (b) Limit on information available. The information entered on each contractholder may be sketchy at best.
   (c) Timeliness of information. Most management reports may available only on a monthly or quarterly basis. Major disintermediation may be recognized too late.

[2]The following is based in part on Bruce Crozier's paper "The Practical Aspects of Managing Fixed Annuity Blocks of Business" contained in these proceedings.

(d) Reversals. Ability to properly reverse and account for reversal of policies or specific cash transactions can be very difficult.

3. Asset Administration.

   (a) Limits on information available. Usually the asset administration systems are the systems that are slowest to be updated. Also conversion from older systems to more current systems may create asset records with incorrect, or insufficient or just different information.

   (b) Segmentation of assets. If the assets backing the funds are pooled with assets backing other funds, there is the difficulty of allocating the funds between different blocks of business, products, and plans and contractholders.

   (c) Timeliness of information available. Dramatic changes in the market value of the assets that are backing the products may not be obtained in a timely fashion for one to make proper strategic decisions.

Several other difficulties in the overall administration of the products are:

1. Setting the crediting rate. This is a balancing act between the demands of the distribution channels, competition, contractholder expectations and the rate that best meets the company's pricing expectations.

2. Resolving organizational conflicts. Here the challenge is to overcome conflicting interdepartmental goals such as profit demands, sales and persistency objectives. This is intimately related with point 1 above for general account based products.

3. Timing differences. There is great difficulty in implementing a new investment strategy in a timely fashion. I have seen a simple investment strategy take over two years to implement in one of our subsidiaries. By the time the strategy is implemented, it may be outdated! Also, there is difficulty in making sure that what is implemented actually matches the original strategy, especially when those setting the strategy have no direct control over those living with it.

4. Shortcomings of modeling. It is difficult to quantify the critical investment risks. Also, it is a very time consuming process to evaluate alternative investment strategies, let alone to pick those that are optimal.

5. Remaining competitive. As economic conditions change, determination and management of new products that efficiently address those new conditions is difficult. An example would be trying to continue selling fixed account products in a flat yield curve environment. Currently these products are unable to compete with certificates of deposit. Another example is dollar cost averaging products. Here a big interest rate is paid (such as 8% to 12%) during the initial year on the condition that the money is dollar cost averaged into variable funds. The difficulty is how to invest for these to minimize losses and risk.

8 Conclusions

The complexity of properly managing IAP contracts run the gambit from understanding how to manage discontinuities in the stock market to understanding why contractholders transfer their money. I hope that this discussion and the other papers in the proceedings will reveal some of the various difficulties and risks associated with IAP contracts, and enable you, the reader, greater insight in their management.

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