RECORD OF SOCIETY OF ACTUARIES
1995 VOL. 21 NO. 2

IS FOREIGN EXCHANGE FLUCTUATION (FEX) AFFECTING YOUR BOTTOM LINE?

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The panel will present current accounting standards and research activities in process to provide actuaries with techniques to manage currency risks.

MR. JOEL C. MAGYAR: I am senior vice president and chief actuary of New York Life Insurance Worldwide Holding, Inc., which is a subsidiary of the New York Life Insurance Company. We manage New York Life's foreign operations in Hong Kong, Indonesia, South Korea, Taiwan, Bermuda, the U.K., Argentina, and Mexico.

Our speakers will be presenting an overview of techniques currently in use for handling the foreign exchange fluctuation (FEX) risk. They will address how to measure, price, model, and account for it.

The first speaker will be Pete Smith. Pete has worked for the American Life Insurance Company, a life subsidiary of AIG, as life actuary for the past four years. He is responsible for developing asset/liability models for U.S. Statutory and GAAP requirements. Previously, Pete worked for the New York State Insurance Department as supervising actuary, where he was responsible for Regulation 126 and Regulation 128 filings. He was responsible for the product development function at Farm Family Life Insurance Company and League Life Insurance Company in prior professional employment. Pete will give an overview of the FEX problem and the various solutions and techniques currently being used.

Our second speaker, Mark Abbott, is a senior analyst at GAT, The Global Advanced Technology Corporation. Mark directs the simulations interflex platform (SIP) asset/liability software integration, and SwapBook development and marketing. He also assists GAT with research and consulting products. Mark joined GAT in 1990 and directed GAT's acquisition and development of Drexel's FIRA software and assembled the team that developed the collaterized mortgage obligation (CMO) analytics system Precision. Prior to joining GAT, Mark spent four years at Drexel Burnham Lambert as vice president of the Arbitrage Software Group of Government Securities, Inc., where he designed proprietary analytics for trading. Mark has a bachelor of arts degree from Columbia College in mathematical statistics and computing science, and he has a master of arts in mathematical statistics from Columbia University. Mark will discuss some of the more theoretical, complex modeling that is currently going on.

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†Mr. Tell, not a member of the sponsoring organizations, is Manager of Ernst & Young LLP in Hackensack, NJ.

Our final speaker is Eric Tell, who is a manager at Ernst & Young, where he works with the Insurance Industry and Practice Group. Eric is a CPA. He has spent his entire career with Ernst & Young, where he has been involved in several international insurance engagements. His most significant client is a major global insurance group, which is predominantly in the property and casualty business, but he does some life business as well. Eric holds both an MBA and an MS degree from Rutgers University. He will cover the accounting aspects of foreign exchange.

MR. PETER L. SMITH, JR.: Before beginning my presentation, I'd like to pause for a brief message from our sponsor. The Society of Actuaries has produced two tapes on *Managing Currency Risk* by Steve Lindo and Richard Long. Lindo discusses many of the nonquantitative considerations, such as political risk, in managing an international financial operation. Long discusses the basis of forwards and futures. For those of you who believe the expression charismatic actuary is an oxymoron, I believe you will find the presentations on these tapes a pleasantly surprising paradigm for your own presentations.

I am going to explore various aspects of foreign exchange risk in life insurance company operations. First is products that are priced in multiple currencies. In many regions of the world, when life insurance companies sell their contracts, they allow the policyholder to choose the currency in which benefits will be denominated. This raises questions regarding the appropriate consistencies in long-term interest rate guarantees between products and associated investment strategies. For example, if long-term single premium deferred annuity (SPDA) and GIC contracts are offered, what patterns of guarantees are appropriate given the widely varying yield curves of interest rates underlying the products offered?

Second, there are duration mismatch problems. Many foreign markets lack the range of investment instruments available in North American markets. The associated liability durations may be as long or longer than the liability durations of comparable North American products because of differences in savings propensities and other factors. But, only shorter-term investments may be available. Use of offshore investments may narrow duration mismatch. An example of the use of offshore investments is found in Japanese regulation which allows up to 30% of domestic Japanese company assets, used to support yen-denominated liabilities, to be invested in offshore assets.

Yield pick-up opportunities exist in many places in the world. Because of the shortage of asset instruments that are available, you may pick up yield, even with fully hedged assets. For example, you can use differential interest rate swaps or quantos as investment hedges.

The Capital Asset Pricing Model (CAPM) suggests that an optimal worldwide portfolio would provide greater return for a given level of risk or less risk for a given level of return than any optimal national portfolio. Products using a worldwide strategy potentially would provide greater value to policyholders and greater profit return to a company than a purely national investment strategy. Variable or unit-linked products employing such strategy features have been developed overseas.

There is a large body of research available regarding hedge assets. Hedged positions may entail partial currency risk. For example, the use of short rolling forwards and futures with

maturities of 60 or 90 days expose the investor to risk of the availability of hedges at the time of rollover.

How do you measure and adjust for FEX effects? Many non-U.S. jurisdictions have foreign currency fluctuation recognition mechanisms. However, the U.K. and Japanese requirements are highly influential and typically material for international insurance companies.

U.K. currency testing requirements emerge through the resiliency testing process. Resiliency testing compares reserves and assets as determined according to variations specified below. Resiliency testing is applicable to an international company's operations for each separately denominated currency liability portfolio along with its currency-matched assets. For any residual currency mismatch, the currency is assumed to depreciate by 25% with respect to the associated assets.

At least 80% of the assets must be maintained in associated liability currency for traditional products. There are exceptions to this rule for property-linked, index-linked, and unit-linked products.

The five resilience tests are as follows:

1. Nonparticipating business only:	Bond yields rise by 3%.
2. Nonparticipating business only:	Bond yields fall by 20% and equities fall in value by 20%.
3. Participating business:	Bond yields fall by 20% and equities fall in value by 10%.
4. Participating business:	Bond yields fall by 10% and equities fall in value by 25%.
5. Participating business:	Bond yields rise by 3% and equities fall in value by 25%.

As an example, consider the application of test 5 to a U.S. dollar participating portfolio. Assume the valuation date conditions before applying the test are as follows:

Assets (U.S. $ million)		
Dollar bonds	6	
Dollar stock	3	
Sterling cash	1	(@FEX rate on valuation date)
	10	(backing dollar policies of 10)

The results after applying Test 5 stresses are then:

Assets (U.S. $ million)		
Dollar bonds	4.50	(yields up 3%)
Dollar stock	2.25	(market values fall 25%)
Sterling cash	0.75	(currency -25%)
	7.50	

If the revalued reserves are $8 million at the revised market yields, then a mismatch reserve of $0.5 million is required under this test.

Under Japan's currency fluctuation valuation requirements, listed foreign bonds (that is, those bonds listed on some international exchange) are valued at the lower of cost and market. Therefore, adverse currency fluctuations below cost are reflected in revised book values. Unlisted foreign bonds are revalued when rates fluctuate by at least 15%. These adjustments are applied to acquisition cost. Changes in the book value of assets are included as adjustments to income.

Multinational insurance company subsidiaries are usually independent, autonomous entities, if only because of local regulatory requirements. Hence, the functional currency for insurance subsidiaries is usually the currency of the country in which they are domiciled. Foreign investments made by the subsidiary are "remeasured" into the functional currency by the temporal method (*FAS 8*) with translation of the functional currency results into the reporting currency by the all-current-rate method (*FAS 52*). For both the temporal method and the all-current-rate method, monetary assets are translated into the functional currency on the balance sheet at the current exchange rate. I refer to an analogous method of reflecting foreign exchange fluctuations for asset/liability work as the current-rate method.

Under this method, foreign investments are valued in the local insurance company's functional currency at the exchange rate that's current as of the valuation date. This method does not anticipate future exchange adjustments.

Another method is the interest-rate-parity approach. All of you have read about taking interest rate parity into account. With interest rate parity, you should ultimately be no better off buying higher yielding foreign assets than if you purchased domestic assets. Therefore, you can make an adjustment to your offshore assets to reflect what you would have purchased, if you had bought them in the local currency. An imputed foreign exchange rate is utilized over some adjustment period.

There are a number of methods available for valuing currency risk. One approach, which I call the correlation spreadsheet approach, is represented by J.P. Morgan's *Riskmetrics*. This is available as a public service on the Internet. *Riskmetrics* consists of an EXCEL spreadsheet plus a database. The spreadsheet enables the user to input various assets and evaluate total portfolio volatility by providing volatility and correlation tables. Over 53,000 correlations among more than 300 key price variables are computed and available daily. The *Riskmetrics* system does not allow the evaluation of credit, operational risk (that is, payment or settlement instruction errors), or liquidity risk. Only market volatility risks are evaluated. The major measures of risk are the Daily Earnings at Risk (DEaR) and Value at Risk (VaR). VaR is the monthly counterpart of DEaR. DEaR is the market sensitivity value of a given position to an incremental change in price. This is visible in the following equations:

Formally:

$$\text{DEaR}(x) = V(x) * dV/dP * \Delta P$$

where $V(x)$ is the market value of security x
dV/dP is the derivative of $V(x)$ with respect to P, that is, price
ΔP is incremental change in price

DEaR may be defined for a two-asset portfolio $\{x,y\}$ as follows:

$$\text{DEaR}(x,y) = [V^*[C]^*VT]$$

where $V = [\text{DEaR}(x), \text{DEaR}(y)]$, that is, DEaR vector.

$$[C] = \begin{vmatrix} 1 & p(y,x) \\ p(x,y) & 1 \end{vmatrix}$$

VT is the transpose of V
$p(x,y)$ is the correlation between x and y.

This process may be generalized to a portfolio with n members.

Price movements are assumed to follow a stable random walk, conforming to a normal distribution.

Correlations and volatilities are estimated using an exponential moving weighted average, such that the most recent observations receive the greatest weight. The significant value that J.P. Morgan volatility and correlations add to portfolio market risk calculation results from the care with which consistent data points are observed and measured. The magnitude of the consistency and measurement problem may be understood by observing that some international market is open at any given point within a given day. Yet consistent, statistically credible data, as of the same point in time, must be obtained so that correct correlations are computed.

Another method of evaluating foreign exchange position is to use formulas such as Black-Scholes, Black-Scholes-Garman-Kohlhagan, or a simple binomial lattice. If someone has a value for a hedge, and you just want to get some sense of comfort as to whether you believe it or not, you can often use one or another of these formulas. Such methods can often provide checks on values or assessments obtained from external sources. These methods view the foreign currency exchange fluctuation as a single variable rather than the interaction of two separate yield curves. The latter representation is often needed for cash-flow testing. Volatility assumptions are sometimes difficult to obtain. If an algorithm is historically validated by comparison with values of publicly traded instruments, an inverse process may obtain the current implied volatility.

Monte Carlo simulation is yet another method. Most actuaries are fairly familiar with this, since it is on the Society of Actuaries Syllabus. It is a technique that is very easy to implement. My problem with Monte Carlo, in terms of FEX risk, is that, in arbitrarily generating combinations of different interest rates, you are going to get many points that are impossible since the changes in the interest rates may be contradictory.

The final method I want to mention is N-dimensional lattices. Mark Abbott will be talking extensively about this. However, I want to include it for completeness and comparison with the other methods. N-dimensional lattices allow a dimension for each variable evaluated. Arbitrage-free conditions are reflected in the construction of the multidimensional lattice. Construction of these lattices can be a daunting task.

Each of the methods that have been described has advantages and disadvantages. The U.K. method is a stress test using a 25% adverse foreign exchange fluctuation. The method may be appropriate for statutory testing. For example, there are elements in Regulation 128 in the United States, where parameters like the 25% volatility parameter are coming from U.K. standards. However, the method appears too arbitrary for use in financial modeling, where one is attempting to achieve some kind of best estimate, and too conservative for GAAP. The method may not be conservative enough for a locality where, because of political instability, drastic foreign exchange losses may emerge.

I view the Japan requirement as essentially the same as the current-rate method, neglecting the difference in asset valuation methodology. Hence, the following comments that are applicable to the current-rate method are applicable to the Japan requirement.

The current-rate method is most rational when applied to a very large diversified company with no foreign assets supporting local liabilities, operating in many currencies without excessive concentration in any given country. In such circumstances, a company may expect that its net long-term currency fluctuation from its reporting currency is zero. Different asset types experience different levels of correlation with currency fluctuation. For example, bonds are highly correlated with interest rate changes, and therefore, currency fluctuations, while equities, are less correlated. To the extent that a company views an investment in a subsidiary as an equity investment, there may be less need to hedge that investment. Such a company may find no need to systematically hedge other than when extraordinary circumstances with regard to a particular country suggest currency hedging is appropriate. If these conditions do not exist, currency hedging should be explored.

The interest-rate-parity approach is best suited to investments that are expected to be held to maturity or over a very long investment horizon, because interest-rate parity is often not validated over short time periods. This approach is not recognized by any accounting methodology. The method would be fuzzy to implement because of uncertainty in the choice of the time period and the manner in which initial yields are graded to their expected ultimate values. Perhaps even more disconcerting is the possibility that currency exchange movements, more adverse than expected, may occur while in the process of performing the grading. Would the grading be reinitialized or would the difference be viewed as a momentary deviation of actual from expected?

The correlation spreadsheet approach is best suited for evaluating short-term risk positions for trading accounts. The DEaR and VaR measures represent daily and monthly expected volatilities, respectively. These measures may be insufficient with respect to portfolios held for extended periods.

Direct calculation is a useful fast tool for ballpark checking of values from external sources. The methods are usually "fast and dirty" such that differentiation between a "cheap" or

"rich" asset is not feasible. Cash flows are not produced, so the method may not be useful for asset/liability modeling analysis.

Monte Carlo methods may be very useful depending on the question confronting the model builder. The major advantage of Monte Carlo methods is their flexibility in adding new model variables. The disadvantage is that arbitrage-free conditions are not necessarily produced by the model. Research into more computationally efficient methods and constraints that produce arbitrage-free results is highly desirable.

N-Dimensional models hold the promise of providing a medium in which actuaries may do cash-flow testing, while having a facility to produce analytics which investment people would trust enough to use to make an investment decision. These methods represent a higher hurdle in terms of cost and effort, but depending on a company's resources and desire of integration of the asset/liability management process with the actual investment decision-making process, this method may be the most appropriate.

MR. MARK ABBOTT: I'd like to share some recent N-factor modeling and global risk measurement work we have been doing at Global Advanced Technology Corporation and explain what is directly applicable to foreign exchange risk problems. In fact, this N-factor interest rate framework lends itself to global asset/liability management.

Let's start in terms of the traditional global methods. You usually want to value securities in different markets from a perspective of your local currency. One of the ways that it's being done today is to look at the different curves and just calculate what the value is in the foreign currency. Then use the current spot exchange rate to convert what it's worth today into the local currency. While that's an immediate, tangible result, it doesn't say anything about what its value would be if, a month or ten years from now, interest rates shifted to different levels. During that process of movement, there might have been jumps of interest rates and fluctuations in yield volatility in either of the two markets. These movements could be correlated or independent. These are the types of scenarios that we thought about and so we asked, what is the best way to value securities or asset/liability management models, where there is a high level of uncertainty?

We started by looking at the research that's currently available and implemented some of the N-factor models that were described in the literature. It was important to develop an arbitrage-free model for risk/neutral valuation. In this framework, when you're given prices of interest rate options like caps and swaps from the marketplace, you can back out their implied forward volatilities. We took this approach and asked ourselves the following, can we do this same sort of thing for every currency in the global framework? What about dual currencies to calculate implied correlations and exchange-rate volatilities?

Foreign exchange is a primary component in this problem. There are prices in different markets, and we have uncertainties about how they're going to move in the future. In fact, forward exchange uncertainty needs to be considered. One needs to extend the one-factor or one-currency arbitrage-free framework to a multicurrency framework. Start by looking at dual currency interest rate curves. What is needed to actually pull this together, to come up with valuation in an arbitrage-free fashion?

Before discussing multicurrency, I'll talk about some of the interest risk measures that we've already applied to single currency valuation at GAT. Pete Smith mentioned the importance of price sensitivity to different changes in yield curve movements. One measure, called effective duration, is the price sensitivity to parallel movements of the underlying spot curve. Dollar duration is another of the conventions that has been used by single currency risk managers. These have been extended to Tom Ho's key rate durations, or equivalently Bob Reitano's partial durations, which measure the sensitivity to changes in specific regions of the yield curve and thus measure nonparallel movements. For derivatives, especially swaps where the price may be zero, we use key-rate dollar durations to measure price sensitivity to kinks or nonparallel movements in the yield curve. We do this by bumping up the rates around different key terms in the underlying spot curve. For example, to get a sense of the sensitivity to a one-year rate, start with the underlying currency spot curve and linearly shift it up a specified number of basis points from the previous term, the three-month key rate, up to that one-year key rate, and then down again to the two-year key rate. Hence, we partially changed that curve from the initial curve. We can then calculate duration from the three market values for the original curve, a shifted-up curve and a shifted-down curve. By the way, the sum of these partial shifts is equivalent to a parallel shift for small basis-point shifts. Using this methodology, we can get a good estimate of interest rate sensitivity.

For dual currency swaps, or for looking at instruments that are sensitive to rates in more than one currency, the same interest risk measures can give us a sense of price sensitivity within a particular currency. How sensitive is it to changes in movement of one or both currencies? What if we're examining a Quanto or a Japanese interest rate index, but it is being valued back in dollars, that is, discounted in dollars? This has a sensitivity for its exposure to changes in the yen curve, as well as the dollar curve. Surprisingly, they are not independent. However, the majority of the sensitivity can be explained by again looking at these separately with duration tools. This has come together in the modeling universe, and we have oriented these interest rate risk measures appropriately. Arbitrage-free N-factor modeling of the universe of interest rate simulations requires correlations and volatility of exchange rates for the dual currency or multicurrency problems.

Pete talked about Monte Carlo simulations. GAT has a structured sample model called linear path space that we map on top of an arbitrage-free binomial lattice. With a one-factor model in a US currency for example, we can get simulations of many different interest rate paths for a bond, a portfolio, or an asset/liability management problem. Basically we came up with what we call a pathwise profile for assets and/or liabilities. The market value is a weighted average of many pathwise values. A pathwise value is determined by walking along a particular scenario and chaining together the discount rates and discounting all the cash flows back to the basecase date to determine the present value for the path. Think about a Monte Carlo simulation where, for each of the scenarios, you simulate forward monthly choices of going up or down in a binomial lattice over 360 months. This is a fairly large sample space. That's too many paths even for today's computing power. We structured it down into a much smaller sample in linear path space but incorporated appropriate weights and rate layers to capture the volatility needed to price caps and floors.

Most option models that are applied today are one-factor models. The computational speed involved in backward substitution is very fast. However, Monte Carlo simulations based on underlying binomial lattices, such as the Ho-Lee, Black Derman Toy, or some of the other variations that are around, require much compute time and require thousands of paths to converge to a fair price. Most importantly, these models need mean reversion or term structure of volatility.

With two-factor models, we move to the world of lattice pyramids. From each point, instead of having just an up or down path, you now have four possibilities. I'll go into this in detail shortly. There are several variations for these two-factor models. The most appropriate for the context of this session is the different currency interest rate curves. For basis risk, one needs to look at one currency's movement and correlation of long and short interest rate movements. In the case of convertible bonds, or equity index options, the model must consider correlation of stock price and interest rate movements.

Some of these modeling issues were actually addressed very recently in a paper by Jason Z. Wei which is titled "Valuing Differential Swaps," in the *Journal of Derivatives*, Spring 1994. He developed a two-factor model for long and short rates and extended it over to dual currencies. The inputs to this particular problem would be a rate curve for the domestic environment, as well as the volatility term structure for the domestic interest rate environment. Similarly, one would input the foreign interest rate curve and volatility term structure. We then need to determine and input the correlation of the particular index and discount terms for the domestic and foreign interest rate environments. Next, and this is the surprising part, you also have to use the correlation of the foreign interest rate and the foreign exchange rate. Finally, in order to make it arbitrage free, the model requires the volatility of the foreign exchange rate. All those factors are required to make it an arbitrage-free equivalence to either buy a Quanto or to receive a coupon set by an index in a foreign currency and pay in that particular currency. Then you can exchange the coupons using forward exchange rates back to a local currency, and finally, discount them back to determine the present value in your local currency.

In terms of the 2-factor lattice pyramid and the movements from every single point in an arbitrage-free lattice pyramid, we're basically going to get movements where both foreign and domestic curves go up and both go down. In addition, they move in contrary motions, one up and the other down and vice-a-versa (Chart 1). Extend this forward monthly or even more frequently, perhaps even weekly. Obviously, with rollback solutions—the typical backward substitution that was introduced in the last decade—this lattice pyramid slows down considerably the process of valuation versus a binomial lattice.

Let's also consider the effect of the correlation on the distribution of rates. In Chart 2, we have a very high, positive correlation, which can be seen by the distribution of rings of rates. Each foreign curve's correlation with your domestic curve influences the valuation.

CHART 1
2-FACTOR LATTICE PYRAMID

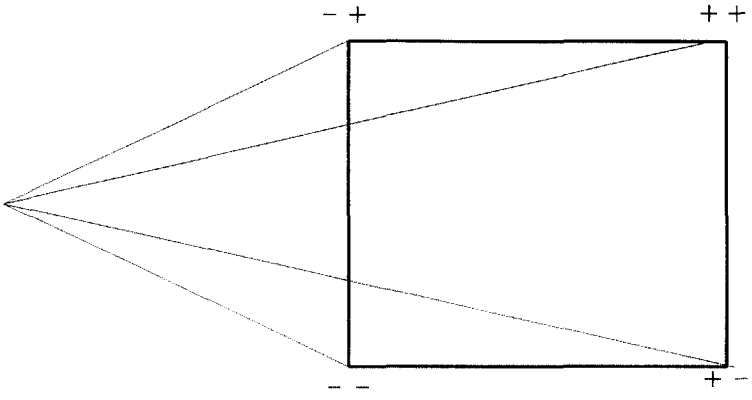
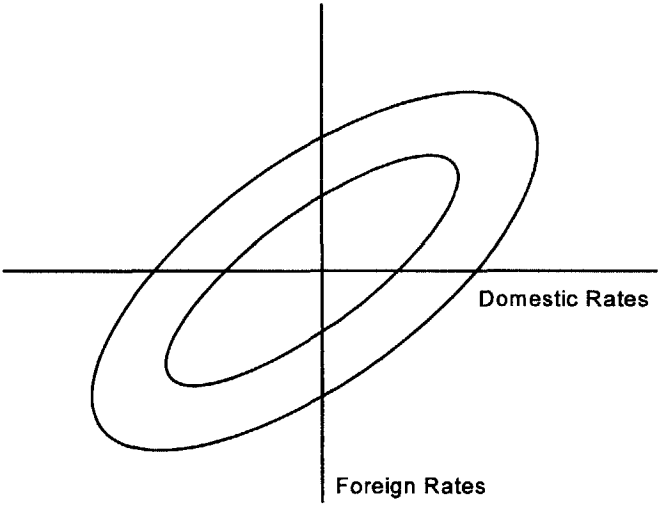


CHART 2
EFFECT OF CORRELATION ON DISTRIBUTION RATES



The benefits, once you've set up a 2-factor framework, are immense, provided you have made sure that the framework is arbitrage-free with respect to all currency curves. It facilitates global valuation, so you can now view things from any currency perspective and get a sense of your value and risk exposure. It is possible to think about simulations using linear path space and even stress tests to determine the worst possible scenarios.

Next, I'll present what goes on with sort of dual currency performance profiles, relative to each of the currencies. We have multiple parallel shifts of the interest rate movements to create sort of a three-dimensional picture of shifts relative to each of the two axes. Given a domestic curve and the foreign curve, we can determine the price sensitivity for each point in that image. Keep in mind that each point has been calculated by running through a simulation using the lattice pyramid to determine a price. This is especially useful in providing a measure for nonlinear risk.

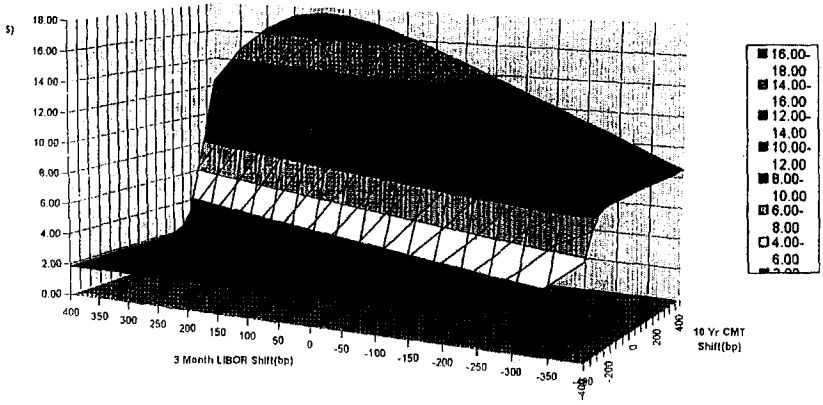
We're also developing a dual currency linear path space. This basically reduces the number of lattice scenarios, assigning probability weights appropriate to the distribution of rate movements through those particular levels.

I'm now going to walk through a couple of examples that we simulated using GAT SwapBook. I won't go through all the details, but basically, the first example is an instrument that is sensitive to long and short rates. This implementation of a two-factor model is probably the most interesting, so I'm going to use it first, just to demonstrate the dynamics that are occurring in the performance profile. It's a yield-curve limited flattener accrual floater. This instrument benefits when the yield curve flattens in a limited way. There's a term called the spread, which is the difference between a ten-year constant maturity Treasury (CMT) and a three-month London interbank offered rate (LIBOR). It's going to accrue a quarterly coupon, in either one of two ways. For each day this spread is greater than 1.25%, it's going to receive the three-month LIBOR plus 2%. When this yield curve flattens, so that the spread is below 1.25%, it only gets a 1% payment. The maximum benefit occurs when the yield curve flattens a little bit so that you continue to receive the floating LIBOR. That's when you make money on this particular deal. Otherwise, you get the minimum 1% accrued each day over the two-year maturity.

You can see from the performance profile in Chart 3 that this is a two-year maturity because the front plane represents the payout of the minimum coupon of just 1% per year with some discounting factors of just under $2. The other axes in the profile are the LIBOR-rate shift and the CMT-rate shift. When the curve is flat, we basically receive the minimum payout. As it steepens a little bit more, we then come up to the maximum payout, which is a plane going up from the right to the left. There's a differential in-between the two planes. We receive the maximum payout along a diagonal and it loses value on either side. This is just one currency, but I think it's appropriate that the same sort of framework applies to dual currencies.

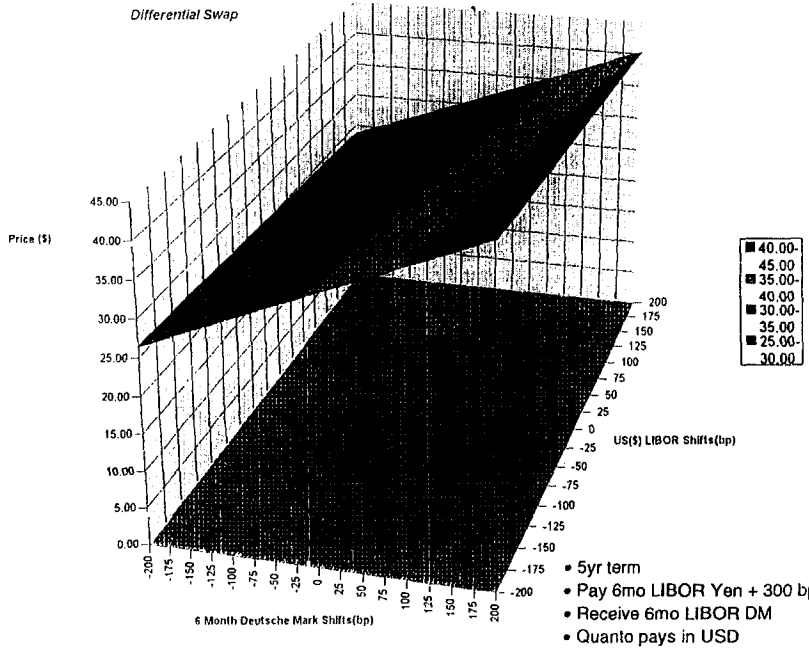
One of the classic multiple currency cases is the differential swap or diff swap. We're basically going to look at it in Chart 4 in two halves, where each is represented as a dual currency model. One side is a yen six-month LIBOR index plus 300 basis points for the coupon that's going to be paid in U.S. dollars; this is termed "Quantoed." The other is to receive Deutsche mark index reset every six months at the floating six-month LIBOR, also paid in dollars. We'll look at the mark-dollar half to measure the sensitivity from the Deutsche mark index rate and the discounting factor from the U.S. LIBOR curve. Chart 4 shows a plane where the majority of the effect is actually due to the index rate, but the discounting effect cannot be ignored.

CHART 3
YIELD CURVE LIMITED FLATTENER ACCRUAL



- 2 year maturity
- spread = 10yr CMT - 3mo LIBOR
- quarterly coupon accrues at
  - floating 3mo LIBOR + 2.00% each day spread > 1.25%
  - fixed 1.00% each day the spread <1.25%.

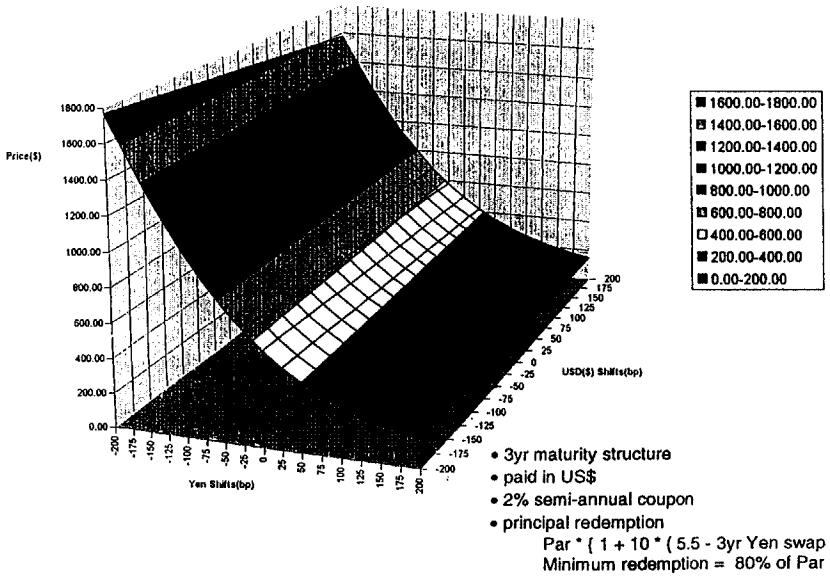
CHART 4
DIFFERENTIAL SWAP



- 5yr term
- Pay 6mo LIBOR Yen + 300 bp
- Receive 6mo LIBOR DM
- Quanto pays in USD

Another interesting dual currency model is the principal-linked inverse floater (Chart 5). Again, it's "Quantoed," so it's being paid in U.S. dollars. We now have a fairly complex formula for the principal redemption and a semi-annual coupon of 2%. The principal redemption is based on the three-year yen swap rate, but that's in a formula where you're subtracting that from 5.5, leveraging it by a factor of 10, adding one to it and then multiplying by the par amount. However, this can't go below 80% of par. The key is the variability of the principal you're going to get back in the end. There is much upside evident in the curve of the graph from the yen shifts. And it goes down to a floor because of the 80% minimum principal redemption. This is a good example of a structured note. If it's used properly, this could be an effective hedge vehicle for a global portfolio. If used inappropriately, without observing the key-rate duration sensitivity, or even this profile, someone can get into trouble very quickly because of the leverage in the formula. At least there is downside protection.

CHART 5
"QUANTOED" PRINCIPAL-LINKED INVERSE FLOATER



- 3yr maturity structure
- paid in US$
- 2% semi-annual coupon
- principal redemption

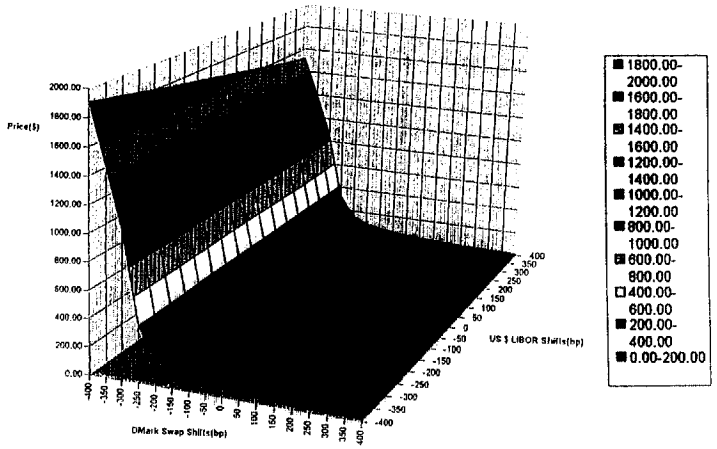
Par * { 1 + 10 * (5.5 - 3yr Yen swap rate)}
Minimum redemption = 80% of Par

One of the more interesting models is the knock-in inverse floater. You get an 8% coupon accumulating and paid at maturity in U.S. dollars. The principal redemption usually has a tight basic range. I made it wider, just for the illustrative purposes. It's going to pay par times 1.05, as long as the two-year Deutsche mark swap stays within this range for the lifetime of this three-year maturity structured note. Otherwise, it pays off a very leveraged inverse floating rate based on the two-year Deutsche mark swap rate below 6.25% and leveraged by a factor of ten.

Chart 6 actually has many interesting areas. If we had no volatility in our term structure of interest rates, and were looking at a static formula rather than a price from a lattice pyramid model, we would actually see that there's a steep drop to a narrow ledge where we are within the range and receiving the fixed rate. Otherwise, we're getting the leverage. Again

it's very sensitive to the Deutsche mark swap rate and not so sensitive to the U.S. LIBOR curve.

CHART 6
KNOCK-IN INVERSE FLOATER

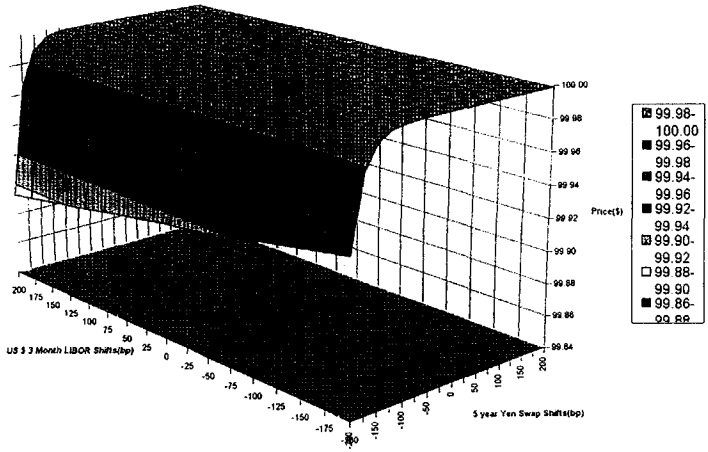


- structured note with 3yr maturity
- 8% coupon paid in USD at maturity
- Principal redemption:
  Par * 1.05 if 2yr DM swap always stays within 9.25% to 3.25% range
  Par * {1 + 10 * (6.25 - 2yr DM swap)} otherwise

The last model is a bearish floater (Chart 7). This is essentially a floating-rate instrument. However, it counts the number of days that the yen swap rate is greater than 4.5% over each quarter; a factor is determined by dividing this number by the total number of days in the quarter. It's going to pay a floating coupon, that's multiplied by this factor. This means you're not getting a floating-rate instrument in all cases. Typically floaters are priced at par. The majority of the price surface is priced at par and that is evident in the price profile there at the top. But, if the five-year yen swap rate falls low enough, so does the market value of this instrument. Once again this shows the relationship of the LIBOR discounting effect at the front with the actual yen swap index rate.

Now what do these have to do with insurance products? Some can be used for hedging purposes; however, I'm primarily using these examples to demonstrate the framework for applying N-factor lattice pyramids to valuation. When looking at any assets or liabilities in a global framework, you need to look carefully at the dynamics of the multicurrency movements. For that purpose, we've developed this framework, this N-factor or multi-factor model approach to measure, monitor and hedge global interest rate risk in the marketplace.

CHART 7
BEARISH FLOATER



- 3yr maturity structure paid in US$ with par principal redemption
- quarterly coupon 3mo LIBOR * factor
- factor = (# days 5yr Yen swap > 4.5%)/(# days in the quarter)

MR. ERIC A. TELL: My portion of the presentation will cover the accounting for foreign exchange. What I would like to do is present a general overview of the accounting framework for dealing with foreign exchange transactions. I will attempt to explain exactly how foreign exchange transactions are impacting the financial statement presentation of a company's financial position and the results of its operations.

I will cover the accounting generally on a GAAP basis, as well as on a statutory accounting basis. In general, on a GAAP basis for typical public reporting, there is a very good general framework for dealing with foreign exchange transactions. A comprehensive framework exists for dealing with many of the peculiar or unusual transactions that might be encountered. The current guidance has generally been in effect since the early 1980s, and, to date, has proven to be very adequate when dealing with many different types of transactions. On the statutory accounting side, however, there is only very minimal guidance available. Hopefully, as the NAIC continues with its codification process, it will address foreign exchange accounting to provide a more comprehensive framework. Ideally, they will achieve something similar to what we have on the GAAP side.

Let us first consider the GAAP basis. *FAS 52* is the primary area of guidance. It lays out the rules for accounting for foreign transactions, how they are accounted and how they are presented. It also provides rules for the translation of foreign operations from their local currency presentation into the U.S. reporting currency for purposes of consolidation.

The first objective of this statement is to attempt to follow the economics of what is going on in the transaction. It tries to capture the way in which the cash flows of an international enterprise are impacted by foreign exchange risks. Second, it lays out the overall framework, the core guidance for translation of financial statements for purposes of presenting a

consolidated financial statement position. As I said, on a GAAP basis, this guidance has been in place for a number of years, and has proven to be very adequate when dealing with many different types of situations.

I have a four step method to apply the specifics of *FAS 52* when preparing financial statements. The first step is to identify the international enterprises, the foreign entities of the business. The statement does not focus on what may be a legal entity, but it gives latitude in defining an entity. It may be a branch or some other functional operational subdivision of the company. Consider a U.S. multinational group, with a German branch operation. Depending on the nature of the German operation it may qualify for purposes of application of the accounting standard as a separate entity.

The statement focuses on whether or not the entity is self-contained or self-sufficient, in other words, whether or not there's a real current exposure from an FEX standpoint on the cash flows in the enterprise. Continuing with the example, presume the German branch is relatively self sufficient in that it has premiums and investments in Deutsche marks which are funding its current obligations for losses as well as expenses. It does not need ongoing investments or infusions of capital on a continuous basis from the parent. Its local cash flows are relatively unimpacted by changes in the value of the Deutsche mark vis-à-vis the dollar which, in this example, would be the reporting currency. In this environment, you could conclude that the German branch is a separate entity for application of the Statement. On the other hand, if the branch were just an underwriting arm, with the operations funded continuously by the parent (maybe it is more of an extension of the parent), the conclusion that might be reached is that it is part of the parent. You don't then have two separate entities.

The second step is to determine the functional currency of each of the entities. In most cases this is obvious when the operations are contained within one geographic area. In our example, the Deutsche mark is the obvious candidate. When there are more frequent cross-border transactions, it becomes a bit more complicated. The Statement gives the company the latitude of using some judgement in determining the real economic substance. For instance, when there is an international financing arm, transactions can be moving through it in a variety of currencies. Analysis of the predominant facts and circumstances would lead to the proper conclusion.

The third step, which is not always necessary, would be to remeasure the local books and records of the foreign entity into its functional currency. Oftentimes, for purposes of local statutory requirements (in our example the German branch), the books and records would be maintained in local currency (Deutsche marks). However, it is possible for purposes of reporting to the parent company, the books and records may be maintained in U.S. dollars. In such instances, before the process of the translation can occur, you go through a step called remeasurement, where the books and records in local currency are essentially remeasured or revalued into the functional currency. For instance, if the branch had actually maintained its books and records in U.S. dollars, but you concluded that the functional currency were the Deutsche mark, you go back through a somewhat complicated process and reconstruct the books and records as if they had always been accounted for in the functional currency. As I pointed out earlier, this is only necessary in certain situations.

The fourth and final step would be to translate the financial statements, which would entail combining the books and records of all the foreign subsidiaries into the reporting currency. You would convert them into the reporting currency of the parent for purposes of inclusion in the consolidated financial statements. This translation process is fairly straightforward. Basically, assets and liabilities are translated at current exchange rates. The tricky part is that the income statement accounts have to be translated at the rates that were in effect when those income and expense items were recognized during the year. For practical purposes, however, most companies simply use a weighted average or an average for the year. Many companies have quarterly reporting. By doing these translations and using a quarter-end approach, they effectively wind up with the weighted average for the year.

The translation process is done for each reporting period. Basically the process revalues the net assets of the subsidiaries into U.S. dollars. The impact of the revaluation, in accordance with the statement, is charged as a separate component to equity. There is no immediate impact to the income statement for the actual mechanical application of the Statement. The logic of the Statement follows from a focus on the cash flows. If a company has a long-term investment in this German subsidiary, the change in its net asset position with exchange rates is more akin to an unrealized gain than to a realized gain. As such, it is charged directly to equity.

At the time, the branch was eventually disposed of and unwound and the assets were liquidated, the cumulative translation impact would roll through the profit and loss as part of the gain or loss on the disposal of the facility. However, this can sometimes produce counterintuitive results. Even though the values of the assets and liabilties and income streams are not impacting cash flows immediately, and there is not an immediate economic cash-flow risk to the company, what might be happening because of the translation process is that these values, as reported, are changing. For instance, in our example of the German branch, assume that the premiums are 100 million Deutsche marks in one year, and then 100 million again in the following year. There is no change in the activities of the operation as expressed in Deutsche marks. However, if the Deutsche mark strengthened, it would appear, in the consolidated financial statements, as if that operation were growing. However, in fact, it is not. This can work against the company in the same manner. Very often companies include some discussion in the management discussion analysis in the annual report to try to neutralize those effects. For example, they may say things like "premiums from our German operation grew at 5%, but excluding the favorable impact of foreign exchange, they were essentially flat for the year."

The other type of foreign exchange impact that is discussed in the Statement is called the foreign currency transaction gain or loss, as opposed to a translation gain or loss. This is supposed to be the one that impacts the cash flows. This would happen, for instance, if the German branch, while having most of its assets and liabilities denominated in Deutsche marks, had one or two denominated in some other currency than its functional currency. Since we have already assumed that the entity is self sufficient, and it is currently funding its operations with its cash flows, then it is going to be impacted by changes in the value of Deutsche marks, vis-à-vis those respective currencies.

The difference between translation and transaction gain and loss is that the transaction gain or loss will be charged directly in the income statement. It will impact results currently.

Again, that is consistent with the FASB's overall concept of trying to match the recognition with the cash flows of the enterprises.

There are some exceptions to the general rules covered by the Statement. The first considers highly inflationary functional currencies. To this point we have been discussing a German branch, but had it been a branch in Brazil, or some other similar country, the impact would be somewhat different.

All of GAAP operates under the assumption of a fairly stable reporting unit. When that assumption is not true, the whole historical cost method of accounting starts to become questionable. Bizarre things may begin happening in the financial statements in a highly inflationary environment.

The Statement gives some guidance as to a definition of value, even though there is some latitude for judgment. The definition provided is that when the cumulative inflation rate over the last three years is in excess of 100%, then it is probably highly inflationary. In borderline cases, some judgment is needed. In the case of a highly inflationary currency, the books and records of the entity are remeasured into the reporting currency, which is presumed to be stable and is typically the dollar. What normally would be a translation adjustment is required to be run through the income statement. With a highly inflationary environment, there is an additional income statement impact.

Hedge accounting is another concept that is introduced in *FAS 52* though it only applies to very limited circumstances. Normally, if you would have a foreign exchange transaction gain or loss, it would be recognized currently. Hedge accounting allows the company, when the transaction item is hedged in accordance with very specific criteria, to defer that gain or loss, and to ultimately recognize it when it recognizes the other leg of the transaction. I will get back to hedge accounting in just a moment.

The last exception is intercompany accounting. Normally, assets and liabilities in differing foreign currencies would require immediate recognition of the effect of swings in value. However, if it is an intercompany amount which is not intended to be settled currently, and is more akin to additional net investment in the subsidiary, gains and losses on such transactions would be deferred. This is similar to a translation type of gain.

Derivative accounting directly relates to hedge accounting, which I mentioned previously. However, the guidance is somewhat insufficient. Right now, the literature regarding the accounting for derivatives as they are used for hedging and the accounting for hedging activities is diverse. *FAS 52* addresses hedging with respect to very particular types of instruments. For instance, it talks about FEX forward contracts and it discusses hedging with various FEX-denominated loans. However, if you were using a futures contract, very similar in structure to a forward contract, it would fall under a completely different accounting framework, and this could lead to different accounting results. The criteria for defining a hedge and for getting hedge accounting treatment, which results in the deferral of gains and losses, would vary under the current literature. It would somewhat depend on the type of investment vehicles a company was using to hedge. When you get into some of the more exotic areas, such as swaps or Quantos for example, or even more exotic types of option situations, the guidance becomes sketchier. Most of the accounting right now is

simply done by analogy to existing Statements. For example, a certain swap could be likened to another instrument that is addressed in the literature. The accounting then follows.

The FASB has been working on its financial instrument project for several years. Essentially, the financial innovations that occurred during the 1980s outpaced the ability of the accounting boards to come up with new standards to address these products. So FASB has been playing catch-up for quite a while. Over the course of the last few years, there have been a couple of new statements. The SEC is very strongly pressing to get some sort of guidance in this area, and it is on the FASB's agenda. Hopefully more will be released in 1995.

The FASB is looking at hedge accounting within a comprehensive framework, attempting to unify the scattered approach to come up with a unified accounting for derivatives in general. Of course, it is still limited. The way in which the FASB defines a derivative relates more to off balance sheet types of items, such as swaps and options. Structured notes and similar items, which do appear on the balance sheet, and which many people would think of as a derivative, escape the accounting definition as it is currently being discussed by the FASB.

Eventually even the FASB's "comprehensive" framework may not be entirely comprehensive, but at least it will be a strong step in the right direction. It will help in knowing where the FASB stands and give some guidance for accounting for these instruments.

The long and short of it is that you can expect that there will be some changes in the way the accounting is done for these products in the near term. Perhaps, we will see something later this year.

On the statutory side, the guidance on derivative accounting again is fairly minimal. There is a bit of guidance available from the NAIC regarding certain types of transactions, but, by and large, there is no comprehensive framework as there is on the GAAP side. It leaves practitioners, to some extent, on their own to figure out exactly how to deal with more exotic transactions or peculiar situations. The explicit guidance that does exist appears to be written under the assumption that much of the foreign exchange transactions that companies face can be dismissed as immaterial. This probably is related with the historical time frame in which it was developed. Since companies have grown internationally over the years, it is no longer adequate.

The view is that, during the codification process by the NAIC, this will be one of the topics that will be addressed. The hope is that they will deal exactly with how these foreign exchange transactions will impact the company's reported surplus and financial statements.

In many instances, many of these foreign exchange impacts can be avoided, simply because a company will establish a holding company responsible for carrying the records of the foreign subsidiaries. This structure does not have a domestic reporting requirement on a statutory basis, so it completely skirts many of these issues.

When there is a U.S. group that has an asset or liability in a foreign currency, the NAIC offers in its practices and procedures manual an approach that, under the assumption of immateriality, allows the company to commingle the foreign exchange currency with its U.S. currency in its assets and liabilities. It would then insert a line item in the liabilities section for the difference in value, so that the net surplus is reported on the appropriate translated basis. In practice, what you see for companies with international subsidiaries, where the net assets are very significant, is a translation process similar to *FAS 52*. The assets and liabilities are translated, shown in the individual line items on the statement with the other U.S. assets and liabilities, and with the adjustment likely going to unassigned funds. That is generally an approach that can be used because guidance is lacking and there is some diversity in practice.