SOME ASPECTS OF CURRENCIES AND EXCHANGE RATES IN THE LONDON MARKET

by F. Duncan and R.M. Hayne

Biographies

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Abstract

This paper is intended for an audience that is not wholly familiar with the considerations in dealing with various currencies and addresses the problem from the viewpoint of the London Insurance and Reinsurance Market (London Market). It begins by giving a brief description of the London Market, stressing the importance to this market of international business.

The importance of estimating currency liabilities and matching them with suitable assets is then explained. Some of the difficulties of estimating liabilities by currency are described. This includes a detailed description of the workings of a London Market Excess of Loss treaty to show how complicated certain insurance contracts can become if exposed to different currencies. The problems of analysing loss development triangles if the underlying data are in currencies are discussed, as are methods of allocating IBNR to currency if derived from grouped data. Certain aspects of the assets side of the question are discussed, and in particular the question of whether the idea that interest rates tend to counteract currency fluctuations over the medium to long term is explored.

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1: INTRODUCTION

The purpose of this paper is to illustrate the importance of, and some of the problems caused by, currency and exchange considerations in the conduct of international insurance and reinsurance business.

It is intended for readers who are familiar with insurance, but not with the problems caused to insurance operations by such as exchange rate fluctuations, and is intended to be explanatory in nature, using the workings of the London reinsurance market as a basis for the illustrations.

2: LONDON MARKET - BACKGROUND

The London Insurance and Reinsurance market must seem a most unusual place to those who have little experience of it, and its peculiarities would take a great deal of time to describe. This paper is intended to deal with only one aspect of its workings, and so this background note is aimed at covering only the information essential for an understanding of the discussion to follow.

Insurance and reinsurance business has been transacted in the City of London since at least the eighteenth century. From the early days there has been an international flavour to the business transacted, since the origins of the business which we shall be discussing are Marine Cargo and Marine Hull policies. We do not intend to include a history of the development of the market, but the following points are relevant to the discussion that follows:

The major players in the market fall under two general headings: the Lloyd's market and the Company market. Lloyd's is an insurance marketplace where the risk carriers are individuals grouped together into syndicates with each member, or "name", having unlimited liability. Co-existing and competing with Lloyd's there is also a market consisting of insurance companies whose underwriting offices are usually based close to the Lloyd's building. The regulation and administration of Lloyd's business is different from that of the companies, but the differences tend to be concerned with capitalisation and taxation; there is no practical difference between the two markets in their treatment of currencies. This similarity leads us to use the phrase "London Market" to mean the combination of Lloyd's and the Company market, and "insurer" to mean a syndicate or insurance or reinsurance company within that market.

A far more significant difference in the treatment of currencies exists across classes of business. Lloyd's syndicates tend to specialise in one of a comparatively small number of major classes of business, of which the most significant from the point of view of this paper are Marine, Aviation and Non-Marine. It is very often the case that these three markets treat currencies differently.

The Marine market is not necessarily concerned only with ships; for example

oil and energy risks and bullion and specie (coins) risks are traditionally written in this market, as also are high level general excess of loss protections, the significance of which will be brought out later. It is not uncommon in the Marine market for claims to be incurred in a currency which is different from that of the original policy. For example, a fleet may place its insurance in London in Sterling, but collision damage may have to be repaired in any part of the world, thus giving rise to a claim whose underlying currency is "foreign".

The Aviation market does specialise in risks which have a connection with aviation, but the connection can include, for example, pollution claims caused by seepage of aviation fuel from underground storage tanks. The London Aviation market traditionally accounts in dollars, such is the dominance of the dollar in the world of Aviation generally. Thus it is likely that a U.K. operator flying a fleet of French-built airliners on routes across Europe will be charged a premium expressed in Dollars.

The Non-Marine market tends to write the balance, which is in effect Fire and Accident (Property and Casualty) business.

There are other classes, for example Motor (Auto) and Life, but these will not concern us here.

A unique feature of the London Market is the method of placing business by means of a "slip". No one insurer will normally take all of a large risk, and the broker has the job of ensuring that the risk being placed has a combined acceptance of 100% from underwriters specialising in the relevant area of the market. Thus all insurers are bound together in that a number of them will co-insure any one particular risk.

Insurers will normally also buy reinsurance for the protection of their account. For example, a Lloyd's syndicate specialising in Property Catastrophe business may wish to buy a policy to pay $Xm excess of $Ym on each loss. This contract will be placed with specialist Property excess of loss underwriters, again using the mechanism of the slip.

The reinsurers of these risks may in turn wish to buy protections, and may well wish these protections to cover all the risks in their account, irrespective of the underlying class of business, or the geographical area covered. It is not difficult to see that, as this process continues, contracts are underwritten for which the insurer can have little detailed knowledge of the primary risks to which it is exposed.

This process of primary, then reinsurance, then retrocession, risks being spread around the market is fundamental to its workings. It means, among other things, that many insurers are exposed, often indirectly, to the same primary risk. The specialist market which writes Excess of Loss coverages on other insurers is known as the LMX (for London Market Excess of Loss) market.

The following table indicates the spread of business by source of the whole of the U.K. market:

TABLE 1: SPREAD OF U.K. NON-LIFE BUSINESS BY SOURCE

	Companies	Lloyd's
U.K. written - U.K. risks	13,228	1,979
U.K. written - other risks	2,761	3,437
European Community (exc. U.K.)	2,359	-
U.S.A. written	3,604	-
Other	3,216	-
TOTAL	25,168	5,416

This table relates to the 1989 written premium estimates provided by the Association of British Insurers, the numbers being in £millions.

Notwithstanding the lack of detail in this table, it does show approximately how widely spread are the sources of business coming into the U.K. insurance market. The Company business which relates to the London Market companies is not shown separately in the table, but the London company market may be taken to be roughly the same size as that of Lloyd's.

In essence the problems start with a very simple one:

Suppose that an insurer writes a contract in a foreign currency where the original premium is P and which turns out to have a loss ratio of R if expressed in the original currency. The exchange rate at which the foreign currency is converted to the insurer's currency is X.

If it can be assumed that there are no exchange rate fluctuations between the insured's currency and that of the insurer, i.e. that X is constant, then the insurer's profit or loss on the contract, expressed in its own currency, is easily determinable:

$$P\ (1-R)\ X$$

Suppose, however, that the exchange rate is not constant, and has values X_p at the time when the premium is paid, and, on average, X_c when the claims are paid. The insurer will now be exposed to further profit or loss on the contract which is attributable to exchange rate movements. This profit or loss will be determined by the insurer's overall philosophy on the treatment of foreign currencies, in particular on the asset side.

If the insurer translates all premium receipts and claim payments to its own currency at the date of each transaction, then the profit on the contract, in the insurer's currency, will be:

$$P\ (X_p - R\ X_c)$$

For example, consider a U.K.-based insurer writes policies covering German-

based yachts. Premiums of DM 1m are payable on January 1st 1985, and the insurer immediately converts the Deutschemarks to Pounds Sterling using an exchange rate of DM 3.64 to £1, which yields £274,682. This exchange rate can be derived from Exhibit 16, and is 3.1480 / 0.8647.

The contract experiences a 90% loss ratio, and (to simplify the arithmetic) all the claims are paid two years later, on January 1st 1987, when the exchange rate has moved to DM 2.85 (1.9425 / 0.6810).

In order to pay the DM 900,000 in claims, the insurer now has to convert £315,521 into Deutschemarks. It has experienced a loss ratio of 115% (i.e. £315,521/£274,682) on a contract whose underlying loss ratio is 90%

We can see from this example that in these circumstances an otherwise profitable contract can become unprofitable if the exchange rate moves adversely, and vice versa. In other words, the profitability of the contract can be viewed, not only as a function of the level of exchange rates and the loss ratio, but also as a function of the variability in the exchange rate. It is easy to see the potential for distortion of the insurer's results if this approach is used.

If, on the other hand, the insurer maintains separate assets in the original currency, then we could think of the profit on the contract as being:

$$P\ (1-R)\ X_r$$

where X_r is the exchange rate which the insurer uses to report its profits to its shareholders or to regulators, etc.

X_r may be different from both X_p and X_c.

Let us return to the previous example, and consider the consequences if the insurer had maintained separate Deutschemark assets. In this event, the final profit on the contract is DM 100,000, and the insurer may translate this to Sterling in his accounts in a variety of ways.

In this approach, the underlying profitability, or otherwise, of the contract is preserved, and the impact of exchange rate fluctuations is only in the way in which they affect the translation of that profit into the currency used by the insurer to report its results. The big difference between the two approaches is that the first approach, in failing to match liabilities with assets in the same currency, exposes the insurer to a currency risk which it may regard as unacceptable, whereas the second, matched, approach reduces the currency risk to the translation of the underlying profit or loss.

These two approaches represent opposite extremes of the possible ways of handling the currency risk. In the second, the insurer treats each area of risk as a separate entity, and consolidates the results of each category in much the same way as it would do if it owned subsidiary companies in different countries.

A company which wrote a wide spread of international business and adopted the first approach would certainly have a simpler administrative system, but at the cost of losing the ability to understand and analyse its statistical data and producing results which are not forecastable or manageable - possibly even leading to insolvency in extreme cases.

On the other hand, a company writing similar business which adopted the second approach would certainly have a more comprehensive statistical base

from which to work, but the cost would be in terms of administrative complexity and expense.

Looked at in this way, the choice that the management of the company has to make would appear to be that of deciding upon the extent to which it will adopt the second, more compartmentalised, approach. In reality, no insurer would contemplate using this method for any but the most significant currencies, and any practical systems will contain some element of compromise.

The discussion so far has been based on an assumption that the underlying risks could be segregated into their currency components if desired. But things are not as straightforward as they appear, because there are classes of insurance and, especially, reinsurance business where the second approach could not be followed at any cost. These have already been briefly mentioned, and some will be discussed at greater length later.

The above simple example has been chosen in order to illustrate some of the basic points: that currency fluctuations can seriously distort the underlying insurance result, and that there are different methods of dealing with the currency problem which can produce different results and require different analysis.

If the second of the above approaches were to be used, there would be little more to add; a separate analysis of the results in each currency would be performed with no reference to the value of that currency, and only after each insurance result had been determined, i.e. at the final consolidation stage, would currency translation take place. The problems would therefore be of an administrative and accounting nature, with nothing particularly new for actuaries.

This paper does not concern itself with cases where this approach is used; its concern is with the problems of insurance portfolios where currency is significant, but where the second method is not, perhaps cannot, be used; why it is not used; and some of the practical methods that have evolved to deal with problems such as these, which are common in the London Market.

It should be clear from the above examples that it can be a matter of vital importance to an insurer involved in foreign currency business that it is able to identify the spread of its liabilities by currency and to find suitable assets with which to match those liabilities.

4: RATING CONSIDERATIONS

In this section we consider the problems caused by currency considerations in the operation and underwriting of an Excess of Loss protection programme.

To simplify the argument we shall restrict ourselves to only two insurers, A and B, and to only two currencies, U.S. Dollars and Sterling. Insurer A writes a wide spread of risks in the Marine, Aviation and Non-Marine markets, and B writes A's protection programme. This is fairly typical of London Market Excess of Loss (LMX) business, albeit grossly oversimplified - A's protection programme would in practice be widely spread, perhaps with a different set of reinsurers on each layer.

Insurer A wishes to protect its account by buying a whole account protection. The coverage will have no geographical restrictions, and will protect

losses irrespective of the original class of business. B's underwriter must of course assess the risks involved, as would be normal, except that the premium charged by B will probably recognise the currency split of the risks by being expressed in two currencies, e.g. a premium of £P plus $D might be payable. There can, however, be exchange rate problems as a consequence of the contract.

Although B assesses the risks in dollars and sterling separately, only one policy is issued. The reinsurance contract must therefore cover the treatment of currencies, and the following is fairly typical example of the wording of a Currency Conversion Clause:

> "For the purposes of this Contract all transactions effected by the reinsured in currencies other than £ Sterling, U.S. Dollars and Canadian Dollars shall be converted into £ Sterling at the rate of exchange ruling at the date of settlement of such transactions.
>
> In the event of the Reinsured becoming involved in a loss applicable to this Contract requiring payment in any or all of the aforementioned currencies, namely, £ Sterling, U.S. Dollars and Canadian Dollars, the sum payable hereunder in £ Sterling, U.S. Dollars and Canadian Dollars shall be apportioned in the proportion that the amount of each currency bears to the total amount of the loss sustained by the Reinsured. For this purpose and for the purposes of calculating the Excess and Indemnity limits hereunder, the amounts involved shall be reduced to a common currency by considering £1.00 = US$ or Can$ 1.60."

This type of wording is fairly typical and highlights some of the major features of the London Market's treatment of currencies. Several points require comment:

Three currencies are mentioned by name in the wording: Sterling and U.S. and Canadian Dollars. These currencies are called the "Settlement Currencies", and all London Market insurers, whether Lloyd's or Company Market, account separately for, and in particular maintain separate investments in, these currencies, although some may hold U.S. investments against Canadian Dollar liabilities, which tend to be very small in relation to the other two settlement currencies.

All other currencies are to be converted to Sterling at the rate of exchange ruling on the date of the transaction. In other words, they are to be treated for the purposes of this contract in exactly the same way as our U.K. insurer in the last section treated the Deutschemark premiums and claims. This is the conventional treatment of other currencies, which are sometimes referred to as "convertible currencies". Although this contract wording implies that all convertible currencies should be converted to Sterling, there are also several currencies, notably those of South and Central America, which are convertible to U.S. Dollars. The phrases "Convertible Sterling" and "Convertible Dollars" are commonly used for these currency groups.

We thus appear to have a hybrid system, where the Settlement Currencies are treated in one way, and the Convertible Currencies in another. This situation arose in times when liabilities in convertible currencies were smaller in relation to the whole than they are now, when exchange rate fluctuations were perhaps less extreme, and when the available computer systems were unable to cope with the extra burden of storing data in original currency.

Attempts have been made recently to extend the list of settlement currencies to include, for example, Yen, Deutschemark, Francs etc., but until now they have run into the problem that the virtually complete market agreement that would be required has not been achieved. The level of sophistication of computer systems is one stumbling block; although a few large reinsurers maintain all data for each reinsurance contract in original currency and can produce corresponding development triangles, such a high level of detail is very rare.

For the purposes of setting excess points and limits, U.S. and Canadian Dollars are interchangeable on a one-for-one basis. This is fairly standard.

Any loss to this contract in more than one settlement currency is to be apportioned by reference to the currency split of that loss from the ground up. It makes some sense for the reinsurance contract to reflect the currency of the underlying claims.

Let us now consider how the above contract would operate in practice, by referring to a specific example:

Policy limits are to be $10m xs of $10m. The limit is expressed in dollars if the majority of A's business is in dollars, which we suppose is the case.

At the inception date of the policy, the exchange rate is $1.60 = £1, and this rate is the fixed exchange rate used in the contract. It is not always the case, however, that the fixed exchange rate reflects that at the inception of the policy. For example, Marine policies often have different exchange rates from Non-Marine policies with the same inception date.

Shortly after the policy is in force, the exchange rate moves to $2.00 = £1.

A is now potentially more exposed to sterling losses: a given sterling loss would be more expensive in real terms now than it would have been if the exchange rate had not moved, but A's ability to recover from B is at the fixed rate of $1.60. If A has properly matched its assets to its liabilities, there should be little difficulty. It may be, however, that the mix of losses by currency has changed in favour of sterling, and in this case A may have to sell dollars at a loss to meet the claims. This may be more likely to happen in catastrophe policies, since such policies are likely to see very small numbers of very large claims.

The above is a fairly simple example of how an asset/liability mismatch is sometimes impossible to avoid. The following example is slightly more complex, but still over-simplified, and is intended to bring out some further points:

Suppose now that A has a protection programme placed with B which consists of four layers, $10m xs $10m, $10 xs $20m, $10m xs $30m and $10m xs $40m.

Now suppose that the various layers have different fixed exchange rates built into them as follows:

Layer:		Value of £1
1	$10m xs $10m	$1.60
2	$10m xs $20m	$1.40
3	$10m xs $30m	$1.75
4	$10m xs $40m	$1.50

The rates shown in this table are random, and are chosen to illustrate the point. In practice every effort would be taken to ensure that all the exchange rates are equal.

Let us now explore the workings of these programmes under three different large loss scenarios.

Scenario 1: An earthquake in the U.S.A. giving rise to a gross loss to A of $45m, all losses being in dollars.

This is the simplest case. A will make claim on each of his layers as follows:

Layer:		Claims made by layer:
1	$10m xs $10m	$10m
2	$10m xs $20m	$10m
3	$10m xs $30m	$10m
4	$10m xs $40m	$ 5m
TOTAL:		$35m

Scenario 2: A severe storm in southern England giving rise to a £25m gross loss to A, all losses being in sterling.

Things now start to get more complicated. A's first layer, expressed in sterling at the fixed contract rate of $1.60, is £6.25m xs £6.25m, so it can make a full claim on this layer.

Moving on now to the second layer and translating to sterling at the contract rate of $1.40, the coverage becomes £7.143m xs £14.286m. But the first layer

has only protected A up to £12.5m. There is now a gap of £1.786m between the top of its first layer and the bottom of its second layer! How this apparent shortfall is dealt with will be explained later.

Following this line of thought through to the third layer, it can be seen that, with an exchange rate of $1.75 to £1, this layer is providing coverage of £5.714m xs £17.143m, and in this case there is an overlap in coverage, because losses between £17.143m and £21.429m are already covered under the previous layer.

Although in normal practice a programme structured in the above way, with widely different exchange rates layer by layer, is highly improbable, the problem that it illustrates is common. Different exchange rates for different layers can occur if some layers are renewed at different dates, or if some layers are placed in different markets.

Before considering the methods which have been developed to solve these difficulties, let us consider one further complication to the two scenarios described above:

Scenario 3: A hurricane crossing the Caribbean before striking the U.S. mainland, giving rise to gross losses of £15m and $45m. To confuse the issue further, the Caribbean losses take longer to settle, and the early estimates are too low, being only £10m.

A's first layer will work as follows: the gross loss in dollars will appear to be $61m ($45m plus £10m converted at the contract rate of $1.60), so A will make a full recovery from B. The wording of the contract requires the split by currency to be in proportion to that of the original gross loss, and so A will receive £1.639m and $7.377m.

The problems of gaps and overlaps are still present, but a new problem has arisen. Consider A's first layer only:

Suppose that the claim that A has made on this first layer is settled immediately by B. After some delay, the Caribbean claims are re-estimated to reach £15m.

A now has to pay further losses and make a further claim from the higher layers, but since the currency split of reinsurance recoveries is to be in proportion to that of the gross claim, B will now have to make an adjustment to the claims already paid to A on the first layer!

The recalculated recoveries should now be $6.522m and £2.174m, which represent the contract limit with a new apportionment to reflect the new currency split of the ground-up claim.

This illustration demonstrates that the administrative work is not finished, in theory at least, even after a total loss to the contract. In practice the process of readjustment may be followed less frequently for those losses which are not very active.

If we turn now to A's and B's management statistics, we can see the following: A has made a $10m claim against B, and this is unchanged as long as conversion is performed at $1.60 = £1.00.

In currency terms, the situation is that A's recovery has moved from £1.639m and $7.377m to £2.174m and $6.522. A's statistics relating to claims net of recoveries will show an apparent improvement of £0.535m and an apparent deterioration of $0.855m, while B's statistics will show the converse. If A analy-

ses its statistics by separate currency it will have to take such complications into account. If, as is more likely, A combines its data triangles together, then no real problem is caused if conversion is done at the rate fixed in the contract, but as far as the authors are aware, this is not common practice in the London Market; it is more likely that the conversion used at dates in the future will be performed at a rate as of that future date. Future statistics will therefore be distorted.

The complexities outlined above will of course be repeated for every layer of A's protection programme, and in turn B's own protections, and B's reinsurers' protections and so on.

The payment of claims can therefore become a fairly complicated and lengthy process. Similar considerations also apply when dealing with reinstatement premiums, because they too are conventionally paid in proportion to the split of the losses to the contract. We do not propose, however, to explore this particular line of thought any further - the same principles hold.

The above scenarios should have given the reader some idea of the difficulty involved in this type of contract. Although over-simplified, the third scenario is parallel to the actual circumstances of Hurricane Hugo. This large loss illustrates a case where different layers are placed in different markets. In this case a series of layers were placed in the Non-Marine market at the same fixed exchange rate throughout, say $1.50 = £1.00. When all the Non-Marine protections have been exhausted (as is the case for many London Market reinsurers), the next layer from which they can recover is one that had been placed in the Marine market, where, because of differing conventions, the fixed exchange rate tended to be $2.00 = £1.

Thus the problems outlined above are more than theoretical; they are very

real.

The possibility of overlaps and gaps appearing in protection programmes in the way outlined above has given rise to clauses in reinsurance contracts known by titles such as "currency fluctuation" clauses. The purpose of such clauses is to ensure that the structure of the layers avoids gaps and overlaps so that the programme does what it is intended to do. It is impossible to specify the exchange rate in the wording of such a clause because there is no way of knowing the currency mix of the claims that will emerge.

The following phraseology is typical of such clauses:

"Where a loss involves payments in United States and/or Canadian Dollars and Sterling, the amounts payable hereunder shall be determined in the following manner:

(1) The amounts recoverable by the Reassured in each currency under any underlying layers, including their net retention, shall first be deducted from the original loss, in each currency.

(2) The remaining United States and/or Canadian Dollar loss shall then be converted into Sterling at the rate of $2.00 equals £1.00 and this figure shall then be added to the remaining Sterling loss to give the total loss applicable to this layer.

(3) The Dollar limit of this Contract shall then be reduced to that proportion of United States or Canadian $2,000,000 which the converted Dollar loss bears to the total loss as established in (2) above. The Sterling limit of this Contract shall be established in a likewise manner.

(4) Reinsurers shall pay the amounts due in United States and/or Canadian Dollars and Sterling as established in (2) above up to the maximum amounts recoverable in each currency as established in (3) above.

Where a loss involves payments in United States Dollars and Canadian Dollars, the amounts payable hereunder shall be determined in the following manner:

(1) The amounts recoverable by the Reassured in each currency under any underlying layers, including their net retention, shall first be deducted from the original loss, in each currency.

(2) The remaining United States and Canadian Dollar loss shall then be added together to give the total loss applicable to this layer.

(3) The Dollar limit of this Contract shall then be reduced to that proportion of United States and Canadian $2,000,000 which the individual currencies bear to the total loss as established in (2) above

(4) Reinsurers shall pay the amounts due in United States and Canadian Dollars as established in (2) above up to the maximum amounts recoverable in each currency as established in (3) above."

Things have now become quite complicated, but the practical effect of this wording is that the excess point of the layer in this contract is re-stated so that it matches the top of the layer immediately below it. In our illustration

above, this would greatly simplify the workings of scenarios 2 and 3; for example, under scenario 2, B would first have to know the exchange rate used by A for its ground-up claims - say $1.60 - and the different layers would become:

Layer	Revised Limits
1	£6.250m xs £6.250m
2	£7.143m xs £12.500m
3	£5.714m xs £19.643m
4	£6.667m xs £25.357m.

Reference was made above to the fact that the Marine and Non-Marine markets often use different exchange rates between Sterling and Dollars. Let us introduce a fourth scenario now - a Sterling Marine loss of £7.5m - and assume that A uses an exchange rate of $2.00 to £1.00.

In this case, B will use A's underlying rate of exchange to calculate the excess point of the contract and arrive at £5m, and so A will be able to make recovery of £2.5m from the first layer. The reader will appreciate that a Sterling Non-Marine loss of £7.5m would have entitled A to a recovery of only £1.25m, because the excess point is £6.25m using the Non-Marine exchange rate of $1.60 to £1.

Hence the size of the recovery under the contract can also be dependent on the class of business of the underlying loss.

5: CURRENCY IMPACT ON ANALYSIS OF DATA

In this section we consider different methods of constructing and analysing loss development triangles when the underlying data are subject to exchange rate fluctuations.

One option, admittedly extreme, is simply to add together the loss amounts in the various currencies, without regard to exchange rates. One could then study the development of the resulting mix and then apply the development factors to the amounts in currency to obtain estimates of ultimate losses by currency. This approach completely ignores relative differences in worth and can, as the following example illustrates, lead to very misleading results.

Assume for this example that we are only considering two currencies, British sterling and the Peruvian inti and only comparing development during one year. Assume further that the losses at the beginning of the year are £10 million and 100 million intis, while, at the end of the year losses are £10 million and 300 million intis. The approach outlined above would imply a development factor of 2.81. In addition, given the volume of the total, we may believe that the development should be rather stable. We would thus conclude that losses for other years at this age would increase by 181%. Thus the next year, having £20 million of losses only in sterling would be expected to increase to £56 million during the next twelve months.

Further examination, however, reveals that there is only one Peruvian claim in the data base and that 842,295 intis are worth £1 sterling (this rate was effective October 5, 1990). Thus this single claim moved from £119 to £356. The true development of all claims was thus insignificant. We really should then conclude that the £20 million above would not move to any great extent in the next year.

One potential solution, as indicated earlier, would be to consider separate development by currency. There are severe practical problems with this approach, especially if one must analyse the experience of several accounts and there are several currencies to be considered.

A more practicable solution would be to combine the data into a single currency. Exhibit 1 is an example of one such combination. The data in this, and following exhibits, though hypothetical, were based on London Market excess of loss casualty development patterns. The exchange rates used in the valuations reflect actual movements in the three settlement currencies as shown in Exhibit 2. Also shown in Exhibit 2 are hypothetical rates for 1990 and subsequent for use in other examples below.

The amounts in Exhibit 1 are all converted to sterling. The paid amounts were converted using the exchange rates in effect at the end of the year that the payments were made. Outstanding amounts were also converted using year-end exchange rates. These amounts thus reflect total incurred, all expressed in sterling.

This approach has one other attractive feature. Conversions need only be done once and a single development triangle will capture all necessary information.

The development in Exhibit 1 appears fairly stable, given the assumed origin. The factor for development after 72 months was arbitrarily calculated using an exponential curve fitted to one less than the selected development factors. The resulting projected ultimate losses in this case are £56.7 million.

Again, further examination shows that these estimates are misleading. Exhibits 3 through 11 show the underlying data in the three currencies; sterling, U.S.

dollars and Canadian dollars. As is clear from Exhibits 3 through 5, the incurred losses for all years in each currency have identical development, except for rounding. We should thus expect no variation in development in the common currency. However variation exists. Why?

The answer lies in Exhibit 2. The U.S. and Canadian dollars showed noticeable movement against the pound during this time. Analysing losses combined as in Exhibit 1 will require that we not only predict the future development of losses but we would also have to predict future relative currency movements.

Exhibit 12 presents another approach to solving this problem. In this exhibit all amounts are converted to sterling using the same exchange rates; U.S.$1.61 and Can.$1.87 for each £1 sterling. Thus there are no exchange rate movements with which to contend. As we would expect, the resulting development factors, except for rounding, show no variation and are identical to the development by currency shown in Exhibits 3 through 5. Here the forecast of ultimate losses is £50.4 million, £6.3 million less than the estimate from Exhibit 1.

This approach requires that entire triangles in each currency be maintained. In addition, the entire development factor triangles can change from one year to the next as the exchange rates change, if there is different development by currency. If the amount of data maintained is a real problem, there is an approach that can maintain the separation between exchange rate fluctuation and actual development. It is preferable to the approach in Exhibit 1 but probably less desirable than that in Exhibit 12.

This alternative requires only that the most recent paid and outstanding amounts are maintained in currency as opposed to the entire triangle. It requires, however, that at each stage of development at which exchange rates change (year-end for example) two values be recorded. The one value in a

single currency combined at each exchange rate. This is shown in Exhibit 13.

The amounts in the "Current" column have all currencies combined at the exchange rates effective at the end of the corresponding year while the "Prior" column represents the exchange rates effective at the end of the prior year. Thus the "Current" column for one stage of development has the same currency conversion as the "Prior" column of the next year.

For example, £2,742 thousand represents the total losses for underwriting year 1984 converted to sterling using the 12/31/84 exchange rates. Similarly, the £6,543 thousand represents total losses for underwriting year 1984 evaluated at 12/31/85 but using the 12/31/84 exchange rates. The £5,243 thousand represents these same losses valued at 12/31/85 exchange rates. Thus the difference between £2,742 thousand and £6,543 thousand represents development while that between the £6,543 thousand and the £5,243 thousand represents a difference in exchange rates.

Development factors are then calculated as the ratio of the "Prior" amounts at one age to the "Current" amounts at the earlier age. These factors are shown in the bottom portion of Exhibit 13 and correspond to those in Exhibit 12. In addition, the last diagonal of the top portion of Exhibit 13 are the same as that of Exhibit 12. Thus the resulting projections would be the same.

This approach can also have application in other situations. Suppose, for example, that case reserves for a book of claims are calculated each year using common inflation assumptions but those assumptions change from one year to the next. This is similar to a change in exchange rates and can be separated using the Exhibit 13 approach without the necessity of recalculating all past values under the same assumptions.

The result of these projections produces estimates of ultimate losses in a single currency. As indicated above, we also need to know the ultimate losses in each currency separately. This then becomes a problem of allocating the forecasts to currency. The equivalent problem is to allocate IBNR reserves to currency. Here we use the term IBNR in the weak sense as the difference between ultimate losses and losses incurred to date. If one were to expect the same development in each currency and incurred development is the only approach used to estimate ultimate losses then the allocation could be accomplished by applying the selected development factors to the losses in currency.

Often other approaches, such as paid loss or Bornhuetter-Ferguson forecasts are also included, so this approach will probably not work directly. Several alternatives present themselves. We could allocate IBNR to currency in the same proportion as premium, incurred or outstanding losses are allocated. We could arbitrarily allocate IBNR to a single currency, or perform an ad hoc allocation if the circumstances warranted it.

Each of these has its advantages and its disadvantages. For more recent underwriting years where losses are immature, allocation based on premium may provide the best allocation whereas, for more mature years, premium may have little bearing on the expected development of losses.

Similarly, allocation based only on incurred losses suffers in early years where losses are immature and may not distinguish between currencies with different tails for very mature years. For example, if U.S. dollar claims tend to take longer to settle than claims in sterling, more of the IBNR probably should be allocated to U.S. dollars. In this situation, outstanding losses would probably give better information for allocation than incurred losses. If, on the other hand, it is expected that only U.S. dollar claims

will have any further development, all IBNR probably should be allocated to U.S. dollars.

One reasonable approach then could be to allocate IBNR based on premiums for recent years, on incurred losses for some of the earlier years, and on outstanding losses for even earlier years.

We can also use the amounts from Exhibit 3 through 12 to highlight the need to immunise against currency fluctuations. Exhibit 14 shows the estimated future payments, in currency. The total using the 1989 rates correspond to the forecasts in Exhibit 3. One alternative would be to keep the supporting assets in sterling which would be sufficient to support this combined column.

However, this approach assumes that the various currencies will remain the same relative to each other. Though we recognise that sterling has strengthened against the dollar during 1990, for illustration purposes, the hypothetical exchange rates in Exhibit 3, however, have sterling weaker relative to both U.S. and Canadian dollars in the future years. In this case, keeping assets in sterling would result in deficiencies as shown in Exhibit 14. If, on the other hand, sterling grew stronger against these currencies, holding assets in sterling would provide a surplus.

If, however, assets were held in currency in the same proportion as unpaid losses, then the corresponding portfolio would be immunised against fluctuations in relative currency strength.

For completeness, we recognise a fourth approach to treating exchange rate changes in forecasts. As noted earlier in this paper, many reinsurance contracts specify the rates to be used for currency conversion. We could reflect this in forecasts by fixing the exchange rate to be used for each underwriting

year. Exhibit 15 provides an illustration of this approach. In this case, the exchange rates shown in Exhibit 2 were used to convert currencies for the corresponding underwriting years.

Again, the development of the various years is the same as in earlier exhibits: however, the forecasts, all in sterling, are no longer comparable. Thus they cannot be immediately combined for financial reporting purposes. They do give unified views of the results for the various years that would be consistent with the conversions inherent in the treaties at the time.

6: OTHER TOPICS

a) Statutory:

It would not be appropriate in a paper of this nature to give a detailed description of the legal framework governing the treatment of currency aspects of insurance and reinsurance in the London Market. The most significant points are:

(i) The importance of foreign business is clearly recognised in the statutory instrument governing the completion of the returns to the Department of Trade and Industry. The forms must state the country of origin of the business and the currency in which the form has been completed. If, as is usual, this is pounds, they have to state the exchange rates used in the conversion.

(ii) The need to match assets to liabilities by currency is recognised in the power of the Secretary of State to make Regulations "...for securing that...the nature of the assets is appropriate in relation to the currency in

which the liabilities of the company are or may be required to be met."

b) Accounting:

Accounting for currencies and exchange rate fluctuations is a very large subject to which we have paid little direct attention in this paper. To do the subject justice would require a considerably longer paper and more expertise than the authors possess.

7: ASSETS

Until now, we have concerned ourselves mainly with questions related to the liability side of the balance sheet, although the last example in section 5 touched upon one aspect of the asset problem. In this we further consider assets and how they are invested. In a paper of this nature and scope it will be impossible to do more than mention briefly a few of the problems.

The standard actuarial approach to the question of investment is of course to match assets to liabilities as far as possible, and this applies to currency as well as to the nature and term of the liabilities. There may be practical difficulties, and some of these will be discussed below.

Expense: It simply may not be worth the expense of setting up the relevant systems if the currency liabilities are small; investment expertise is expensive, and it may be difficult to recruit personnel with enough knowledge of the relevant foreign investment markets. Some large reinsurers in the London Market have very detailed information on their currency exposures, and pursue

active investment strategies in a variety of currencies, but this would not be feasible for even medium-sized companies.

Marketability: The insurer would want to hold assets that were readily marketable, because, when a claim becomes payable, the practicalities of getting the cash to the insured may be a greater priority than having a theoretically matched position. Investments in certain less commonly traded currencies may suffer from this drawback.

Exchange control: There may be restrictions on one's ability to buy and sell foreign currencies. Some governments will require a minimum of assets to be invested locally; on the other hand, past U.K. administrations have placed restrictions on freedom of investment.

Deliberate mismatch: The insurer may take a view on relative currency movements and mismatch accordingly. In the example of the German business mentioned in an earlier section, the insurer may well have taken the view that Sterling would appreciate against the Deutschemark, and deliberately mismatched by buying Sterling. In this case, of course, it would have lost money.

Tokyo Bay syndrome: This argument goes that if an insurer or reinsurer has large exposures to certain catastrophic events, then they should deliberately mismatch their assets and liabilities. The example usually quoted in support of this argument is that of the risk of an earthquake devastating the Tokyo Bay area: the effect of such an event on the value of the Yen, and hence the insurer's ability to meet claims if the assets available were invested in Yen, could be catastrophic. Therefore invest in some other currency which would survive such an event in a strong position.

There is an extension to this argument: Suppose one accepted the above logic

and invested in dollar assets, and suppose that the worst were to happen and Tokyo was indeed destroyed by an earthquake. This argument suggests that the Japanese institutions would be forced to liquidate all, or a large proportion of, their investments in the U.S.A. and other Western economies in order to fund the necessary reconstruction, and that there could well be a consequential collapse in the value of the affected currencies, so one may not have managed to avoid the risk.

Weak economies: If the economy of the country of origin of the risks is extremely weak, there is a case for shadowing the investments in a stronger currency. An example of this might be the case of several South American economies. Claims being settled at today's date may be in a seriously devalued currency, and a reinsurer who had invested its relevant assets in that currency would be suffering severe losses compared to a reinsurer which had held dollar assets against those liabilities. The Peruvian inti was mentioned in an earlier section: its exchange rate against the dollar is in the region of 440,000 to $1. The inti replaced the sol, which was a thousand times less valuable than this, in 1990. It is likely that an insurer would prefer to deal in a more stable currency such as the Dollar for Peruvian risks. Indeed some Israeli contracts are actually denominated in Dollars because of the instability of the shekel.

Purchasing power parity : The idea behind this is that the strength of an economy as measured by such things as inflation and interest rates influences the exchange rate. An investor, assuming that he had total freedom to invest in any economy, and assuming something close to a perfect market in currencies, would take into account both the interest yield and the risk of depreciation of the currency in which that interest is payable before investing. Hence the equilibrium position would be one where the former offsets the latter. The argument then concludes that in the long term an investment of a

given amount of money will yield much the same result no matter what economy it is invested in, because higher interest rates will offset the weakness of a currency.

This notion seems extremely attractive because, if true, it offers a potential solution to virtually all the investment problems mentioned above. Arguments similar to this one have been advanced to explain the perennially high interest rates seen in the U.K. It therefore deserves closer scrutiny. What follows is by no means an economic treatise, but may be interesting nevertheless. It is an extension of Chapter 5 of "Financial Analysis of a Reinsurance Office" by David Craighead, and the authors are grateful for his permission to update the analysis in that book.

Data on exchange rates and short term interest rates were extracted for each of the following currencies: US dollar, Canadian dollar, Pound sterling, French Franc, Japanese Yen and Deutschemark, all of which are fairly significant currencies to the London Market. The period covered the years 1980 to 1990 (second quarter), giving us more than ten years of experience. The exchange rate information was extracted from the Financial Times, and the short-term interest rates from financial statistics published by the Organisation for Economic Cooperation and Development (OECD).

The tables and graphs which make up exhibits 16 to 20 were then constructed by assuming an investment of $100 in each currency on January 1st 1980. The investor converts $100 to the local currency, and buys a three month bond, at a price determined by assuming that the local three-month bond rate is as shown in the table of short-term rates for first quarter 1980. As each bond matures, it is replaced by a new one using the following quarter's short term interest rate to determine the price. The original investment is revalued at the end of each quarter by reference to the appropriate exchange rate back to

Dollars. (Expenses and taxation have been ignored in the calculation.)

The hypothesis, if true, would mean that the "pure" exchange rate fluctuations portrayed in exhibit 19 would be neutralised, or at least significantly damped, by the interest rate effect, and this should become apparent in comparing exhibits 19 and 20.

A word of caution is necessary when considering these tables: if there is an inconsistency between the short-term rates of interest shown, this will probably persist across all the quarters of data, and therefore be compounded in the results. An example of this would be if the definition of short term interest rates used in the Tokyo money markets differed from that used in London. However, given the differences among the operations of the bond markets in the economies considered, one can never be absolutely sure that such differences do not happen.

Only one set of "investments" is shown in the exhibits; clearly the calculations could easily have been repeated assuming a starting investment in any of the six currencies selected, or using a different starting date for the investment. The arithmetic involved is quite simple, and exhibits 16 and 17 contain the necessary data.

Some possible patterns emerge from this exercise:

a) There was a huge growth in the value of the Yen from early 1985 to the end of 1988 relative to the other currencies, but especially the dollar. Its value against the dollar doubled over eleven quarters. It is simple to deduce that the annual rate of interest U.S. in that period would need to have been about 29% higher than that in Japan for the return to be equivalent. Hence it is clear that there can be short-term, even sudden, changes in values

which cannot in reality be offset by differentials in interest rates.

b) There has been, relatively speaking, a decline in the value of the Yen against the other currencies since 1988.

c) The investment return on two North American currencies were fairly close up to the end of 1987, despite the relative strength of the U.S. Dollar,but this was followed by a significant improvement in the investment return on Canadian Dollars since then.

d) The investment returns on the three selected European currencies were fairly similar despite the strength of the Deutschemark in "pure" exchange rate terms relative to Sterling and the French Franc.

It is tempting to draw some tentative conclusions from this analysis:

a) There may be some truth in the hypothesis when the economies concerned are closely linked geographically. Part of the explanation on the European currencies may lie in deliberate government economic policies aimed at maintaining exchange rate relativities within certain limits, but such considerations are outside the scope of this paper.

b) On the other hand rapid changes in relativities can take place for which there is no obvious remedy in interest rates.

It should be stressed, however, that the above analysis is not particularly rigorous. To go further and perform more rigorous and comprehensive research may well prove to be interesting, but that is not the purpose of this paper.

8: CONCLUSION

We have attempted in this paper to touch on some of the problems caused by one aspect, currency, of one area, the London Market, of the world insurance market. In order to keep it to a reasonable length we have avoided detailed discussion of some points which are important nevertheless. Section 6, for example, mentions two very large topics only briefly, and the background to the workings of the London Market in Section 2 is far from comprehensive. For a fuller treatment of some of these topics, we append a short list of material for further reading.

Craighead, David: Financial Analysis of a Reinsurance Office. (Insurance and Reinsurance Research Group, London).

Hart, David (editor): An Actuarial View of Lloyd's and the London Reinsurance Market. (Institute of Actuaries, London).

Kiln, Robert: Reinsurance in Practice. (Witherby, London).

Kiln, Robert: Reinsurance Underwriting. (Insurance and Reinsurance Research Group, London).

EXAMPLE DEVELOPMENT -- CONVERTED AT END OF YEAR

Incurred Losses

Under-writing Year	Months of Development 12	24	36	48	60	72	Forecast
1984	2,724	5,337	8,755	8,965	10,651	11,487	12,486
1985	2,183	5,181	7,173	8,873	11,152		13,070
1986	1,443	2,818	4,863	6,409			9,184
1987	1,011	2,550	4,691				8,022
1988	960	2,572					7,248
1989	1,030						6,667
							56,677

	Months of Development 24/12	36/24	48/36	60/48	72/60	Ult./72
1984	1.959	1.640	1.024	1.188	1.078	
1985	2.373	1.384	1.237	1.257		
1986	1.953	1.726	1.318			
1987	2.522	1.840				
1988	2.679					
Average	2.297	1.648	1.193	1.223	1.078	
Cumulative	6.473	2.818	1.710	1.433	1.172	1.087

HISTORICAL EXCHANGE RATES

	Value of 1 Pound Sterling in	
12/31/	U.S. Dollars	Canadian Dollars
1984	1.16	1.53
1985	1.45	2.02
1986	1.47	2.03
1987	1.88	2.44
1988	1.81	2.15
1989	1.61	1.87
1990	1.40	2.15
1991	1.30	2.10
1992	1.20	2.00
1993	1.10	1.90
1994	1.20	1.95
1995	1.30	2.00

NOTE:

1. Rates for 1989 and prior are actual, for 1990 and subsequent are hypothetical.

Exhibit 3

EXAMPLE DEVELOPMENT -- LOSSES IN STERLING

Incurred Losses

Underwriting Year	Months of Development 12	24	36	48	60	72	Forecast
1984	58	138	231	279	326	331	336
1985	58	138	231	279	326		335
1986	58	138	231	279			335
1987	58	138	231				335
1988	58	138					335
1989	58						335
							2,011

	Months of Development 24/12	36/24	48/36	60/48	72/60	Ult./72
1984	2.379	1.674	1.208	1.168	1.015	
1985	2.379	1.674	1.208	1.168		
1986	2.379	1.674	1.208			
1987	2.379	1.674				
1988	2.379					
Average	2.379	1.674	1.208	1.168	1.015	
Cumulative	5.783	2.431	1.452	1.202	1.029	1.014

Exhibit 4

EXAMPLE DEVELOPMENT -- LOSSES IN U.S. DOLLARS

Incurred Losses

Underwriting Year	Months of Development 12	24	36	48	60	72	Forecast
1984	2,875	6,906	11,528	13,945	16,316	16,534	16,749
1985	2,875	6,906	11,528	13,945	16,316		16,740
1986	1,725	4,144	6,917	8,367			10,040
1987	1,438	3,453	5,764				8,369
1988	1,150	2,763					6,695
1989	575						3,347
							61,940

	Months of Development 24/12	36/24	48/36	60/48	72/60	Ult./72
1984	2.402	1.669	1.210	1.170	1.013	
1985	2.402	1.669	1.210	1.170		
1986	2.402	1.669	1.210			
1987	2.401	1.669				
1988	2.403					
Average	2.402	1.669	1.210	1.170	1.013	
Cumulative	5.820	2.423	1.452	1.200	1.026	1.013

Exhibit 5

EXAMPLE DEVELOPMENT – LOSSES IN CANADIAN DOLLARS

Incurred Losses

Underwriting Year	Months of Development 12	24	36	48	60	72	Forecast
1984	288	691	1,153	1,395	1,632	1,653	1,674
1985	288	691	1,153	1,395	1,632		1,674
1986	431	1,036	1,729	2,092			2,510
1987	460	1,105	1,845				2,679
1988	575	1,381					3,346
1989	1,150						6,691
							18,574

	Months of Development 24/12	36/24	48/36	60/48	72/60	Ult./72
1984	2.399	1.669	1.210	1.170	1.013	
1985	2.399	1.669	1.210	1.170		
1986	2.404	1.669	1.210			
1987	2.402	1.670				
1988	2.402					
Average	2.401	1.669	1.210	1.170	1.013	
Cumulative	5.818	2.423	1.452	1.200	1.026	1.013

EXAMPLE DEVELOPMENT -- LOSSES IN STERLING

Paid Losses

Under-writing Year	Months of Development					
	12	24	36	48	60	72
1984	10	43	74	112	145	174
1985	10	43	74	112	145	
1986	10	43	74	112		
1987	10	43	74			
1988	10	43				
1989	10					

	Months of Development				
	24/12	36/24	48/36	60/48	72/60
1984	4.300	1.721	1.514	1.295	1.200
1985	4.300	1.721	1.514	1.295	
1986	4.300	1.721	1.514		
1987	4.300	1.721			
1988	4.300				

EXAMPLE DEVELOPMENT -- LOSSES IN U.S. DOLLARS

Paid Losses

Underwriting Year	Months of Development					
	12	24	36	48	60	72
1984	500	2,125	3,719	5,578	7,252	8,702
1985	500	2,125	3,719	5,578	7,252	
1986	300	1,275	2,231	3,347		
1987	250	1,063	1,859			
1988	200	850				
1989	100					

	Months of Development				
	24/12	36/24	48/36	60/48	72/60
1984	4.250	1.750	1.500	1.300	1.200
1985	4.250	1.750	1.500	1.300	
1986	4.250	1.750	1.500		
1987	4.252	1.749			
1988	4.250				

EXAMPLE DEVELOPMENT -- LOSSES IN CANADIAN DOLLARS

Paid Losses

Under-writing Year	Months of Development					
	12	24	36	48	60	72
1984	50	213	372	558	725	870
1985	50	213	372	558	725	
1986	75	319	558	837		
1987	80	340	595			
1988	100	425				
1989	200					

	Months of Development				
	24/12	36/24	48/36	60/48	72/60
1984	4.260	1.746	1.500	1.299	1.200
1985	4.260	1.746	1.500	1.299	
1986	4.253	1.749	1.500		
1987	4.250	1.750			
1988	4.250				

EXAMPLE DEVELOPMENT -- LOSSES IN STERLING

Outstanding Losses

Underwriting Year	Months of Development					
	12	24	36	48	60	72
1984	48	96	156	167	181	157
1985	48	96	156	167	181	
1986	48	96	156	167		
1987	48	96	156			
1988	48	96				
1989	48					

Ratio of Outstanding Losses to Cumulative Paid Losses

	Months of Development					
	12	24	36	48	60	72
1984	4.800	2.233	2.108	1.491	1.248	0.902
1985	4.800	2.233	2.108	1.491	1.248	
1986	4.800	2.233	2.108	1.491		
1987	4.800	2.233	2.108			
1988	4.800	2.233				
1989	4.800					

EXAMPLE DEVELOPMENT -- LOSSES IN U.S. DOLLARS

Outstanding Losses

Underwriting Year	Months of Development					
	12	24	36	48	60	72
1984	2,375	4,781	7,809	8,367	9,064	7,832
1985	2,375	4,781	7,809	8,367	9,064	
1986	1,425	2,869	4,686	5,020		
1987	1,188	2,391	3,905			
1988	950	1,913				
1989	475					

Ratio of Outstanding Losses to Cumulative Paid Losses

	Months of Development					
	12	24	36	48	60	72
1984	4.750	2.250	2.100	1.500	1.250	0.900
1985	4.750	2.250	2.100	1.500	1.250	
1986	4.750	2.250	2.100	1.500		
1987	4.752	2.249	2.101			
1988	4.750	2.251				
1989	4.750					

EXAMPLE DEVELOPMENT -- LOSSES IN CANADIAN DOLLARS

Outstanding Losses

Underwriting Year	Months of Development					
	12	24	36	48	60	72
1984	238	478	781	837	906	783
1985	238	478	781	837	906	
1986	356	717	1,171	1,255		
1987	380	765	1,250			
1988	475	956				
1989	950					

Ratio of Outstanding Losses to Cumulative Paid Losses

	Months of Development					
	12	24	36	48	60	72
1984	4.760	2.244	2.099	1.500	1.250	0.900
1985	4.760	2.244	2.099	1.500	1.250	
1986	4.747	2.248	2.099	1.499		
1987	4.750	2.250	2.101			
1988	4.750	2.249				
1989	4.750					

Exhibit 12

EXAMPLE DEVELOPMENT -- ALL CURRENCIES AT CURRENT LEVEL

Incurred Losses

Under-writing Year	Months of Development 12	24	36	48	60	72	Forecast
1984	1,997	4,797	8,007	9,686	11,333	11,484	11,633
1985	1,997	4,797	8,007	9,686	11,333		11,628
1986	1,360	3,266	5,451	6,595			7,914
1987	1,196	2,874	4,797				6,965
1988	1,079	2,593					6,283
1989	1,030						5,995
							50,418

	Months of Development 24/12	36/24	48/36	60/48	72/60	Ult./72
1984	2.402	1.669	1.210	1.170	1.013	
1985	2.402	1.669	1.210	1.170		
1986	2.401	1.669	1.210			
1987	2.403	1.669				
1988	2.403					
Average	2.402	1.669	1.210	1.170	1.013	
Cumulative	5.820	2.423	1.452	1.200	1.026	1.013

Exhibit 13

ALTERNATIVE DATA ORGANIZATION FOR CURRENCY FLUCTUATION

Under-writing	Months of Development											
	12		24		36		48		60		72	
Year	Prior	Current	Prior	Current	Prior	Current	Prior	Current	Prior	Current	Prior	Current
1984	N/A	2,724	6,543	5,243	8,752	8,641	10,452	8,268	9,674	10,100	10,379	11,484
1985	N/A	2,183	5,243	5,176	8,641	6,835	8,268	8,632	10,100	11,333		
1986	N/A	1,443	3,467	2,767	4,618	4,856	5,875	6,595				
1987	N/A	1,011	2,428	2,560	4,273	4,797						
1988	N/A	960	2,307	2,593								
1989	N/A	1,030										

Development Factors

	Months of Development				
	24/12	36/24	48/36	60/48	72/60
1984	2.402	1.669	1.210	1.170	1.028
1985	2.402	1.669	1.210	1.170	
1986	2.403	1.669	1.210		
1987	2.402	1.669			
1988	2.403				

Exhibit 14

FUTURE PAYMENTS

Calendar Year	Sterling	U.S. Dollars	Canadian Dollars	Converted to Sterling 1989 Rate	Converted to Sterling Future Rate	Indicated Difference
1990	208	6,685	1,800	5,323	5,820	-497
1991	210	6,352	1,956	5,201	6,028	-827
1992	200	5,735	1,962	4,811	5,960	-1,149
1993	180	4,949	1,831	4,233	5,643	-1,410
1994	155	4,104	1,632	3,577	4,412	-835
1995	128	3,283	1,397	2,914	3,352	-438

Exhibit 15

EXAMPLE DEVELOPMENT -- CONVERTED BY UNDERWRITING YEAR

Incurred Losses

Under-writing Year	Months of Development 12	24	36	48	60	72	Forecast
1984	2,725	6,543	10,923	13,212	15,458	15,665	15,869
1985	2,183	5,243	8,752	10,587	12,386		12,708
1986	1,444	3,467	5,788	7,001			8,401
1987	1,011	2,428	4,053				5,885
1988	961	2,307					5,590
1989	1,030						5,993
							54,448

	Months of Development 24/12	36/24	48/36	60/48	72/60	Ult./72
1984	2.401	1.669	1.210	1.170	1.013	
1985	2.402	1.669	1.210	1.170		
1986	2.401	1.669	1.210			
1987	2.402	1.669				
1988	2.401					
Average	2.401	1.669	1.210	1.170	1.013	
Cumulative	5.818	2.423	1.452	1.200	1.026	1.013

Exhibit 16: VALUE OF $1 IN SIX MAJOR CURRENCIES

qtr end	year	Canada	France	Japan	USA	Germany	U.K.	qtr end	year
4	1979	1.1681	4.0200	239.7000	1.0000	1.7315	0.4496	4	1979
1	1980	1.1914	4.4785	249.7000	1.0000	1.9419	0.4615	1	1980
2	1980	1.1510	4.0870	217.6000	1.0000	1.7582	0.4234	2	1980
3	1980	1.1705	4.1995	212.2000	1.0000	1.8113	0.4187	3	1980
4	1980	1.1947	4.5160	203.0000	1.0000	1.9590	0.4193	4	1980
1	1981	1.1868	4.9580	211.0000	1.0000	2.1018	0.4456	1	1981
2	1981	1.2005	5.7175	225.8000	1.0000	2.3909	0.5147	2	1981
3	1981	1.2068	5.5670	232.7000	1.0000	2.3225	0.5554	3	1981
4	1981	1.1859	5.7480	219.9000	1.0000	2.2548	0.5241	4	1981
1	1982	1.2303	6.2420	246.5000	1.0000	2.4142	0.5613	1	1982
2	1982	1.2930	6.8290	254.0000	1.0000	2.4598	0.5753	2	1982
3	1982	1.2363	7.1380	269.5000	1.0000	2.5276	0.5908	3	1982
4	1982	1.2294	6.7250	235.0000	1.0000	2.3765	0.6194	4	1982
1	1983	1.2339	7.2695	239.4000	1.0000	2.4265	0.6761	1	1983
2	1983	1.2273	7.6375	239.7000	1.0000	2.5419	0.6534	2	1983
3	1983	1.2323	8.0090	236.1000	1.0000	2.6391	0.6686	3	1983
4	1983	1.2444	8.3475	232.2000	1.0000	2.7238	0.6894	4	1983
1	1984	1.2765	7.9800	224.7000	1.0000	2.5900	0.6932	1	1984
2	1984	1.3194	8.5445	237.5000	1.0000	2.7842	0.7393	2	1984
3	1984	1.3180	9.2840	245.5000	1.0000	3.0253	0.8013	3	1984
4	1984	1.3214	9.5920	251.1000	1.0000	3.1480	0.8647	4	1984
1	1985	1.3670	9.4270	252.5000	1.0000	3.0930	0.8045	1	1985
2	1985	1.3587	9.3170	248.9500	1.0000	3.0607	0.7721	2	1985
3	1985	1.3710	8.1525	217.0000	1.0000	2.6699	0.7138	3	1985
4	1985	1.3975	7.5610	200.5000	1.0000	2.4613	0.6923	4	1985
1	1986	1.3973	7.1325	179.6000	1.0000	2.3175	0.6733	1	1986
2	1986	1.3867	7.0115	165.0000	1.0000	2.1986	0.6535	2	1986
3	1986	1.3885	6.6220	153.6000	1.0000	2.0207	0.6897	3	1986
4	1986	1.3803	6.4266	159.0058	1.0000	1.9425	0.6810	4	1986
1	1987	1.3067	6.0106	146.3831	1.0000	1.8038	0.6209	1	1987
2	1987	1.3335	6.1071	145.2217	1.0000	1.8304	0.6246	2	1987
3	1987	1.3127	6.0825	144.0317	1.0000	1.8255	0.6090	3	1987
4	1987	1.2993	5.3571	122.7612	1.0000	1.5858	0.5330	4	1987
1	1988	1.2324	5.6280	124.1259	1.0000	1.6608	0.5379	1	1988
2	1988	1.2073	6.1377	130.7986	1.0000	1.8188	0.5872	2	1988
3	1988	1.2208	6.4082	134.6731	1.0000	1.8821	0.5999	3	1988
4	1988	1.1907	6.0572	124.9309	1.0000	1.7731	0.5528	4	1988
1	1989	1.2132	6.3523	132.1174	1.0000	1.8817	0.5931	1	1989
2	1989	1.1943	6.5499	141.2044	1.0000	1.9287	0.6339	2	1989
3	1989	1.1766	6.4517	142.6795	1.0000	1.9055	0.6217	3	1989
4	1989	1.1581	5.7860	143.7209	1.0000	1.6915	0.6202	4	1989
1	1990	1.1760	5.7729	156.2887	1.0000	1.7147	0.6196	1	1990
2	1990	1.1608	5.5628	151.2617	1.0000	1.6586	0.5671	2	1990
3	1990	1.1491	5.2123	135.9777	1.0000	1.5574	0.5306	3	1990

Exhibit 17: SHORT-TERM INTEREST RATES: ANNUAL RATE %

qtr	year	Canada	France	Japan	USA	Germany	UK	qtr	year
1	1980	13.95	11.99	8.057	13.39	8.86	17.17	1	1980
2	1980	15.25	12.96	10.73	17.57	9.64	18.11	2	1980
3	1980	11.50	12.43	12.64	8.49	10.11	16.77	3	1980
4	1980	10.90	11.37	11.40	11.29	8.97	16.00	4	1980
1	1981	13.63	10.88	9.72	18.65	10.20	14.73	1	1981
2	1981	16.36	12.57	8.04	14.33	13.60	12.65	2	1981
3	1981	19.14	18.92	7.11	16.90	13.09	12.67	3	1981
4	1981	20.21	17.59	7.26	16.84	12.50	14.78	4	1981
1	1982	15.66	15.26	6.70	12.49	10.82	15.36	1	1982
2	1982	15.38	15.25	6.68	14.21	9.87	13.57	2	1982
3	1982	16.45	15.70	7.19	14.46	9.28	13.00	3	1982
4	1982	13.28	14.06	6.99	10.66	8.18	10.89	4	1982
1	1983	10.08	12.71	6.92	8.66	6.62	10.62	1	1983
2	1983	8.58	12.65	6.69	8.69	5.45	10.95	2	1983
3	1983	7.45	12.63	6.20	9.20	5.57	9.93	3	1983
4	1983	8.05	12.43	6.53	9.39	5.88	9.69	4	1983
1	1984	8.16	12.19	6.44	9.69	6.48	9.43	1	1984
2	1984	8.64	12.54	6.05	10.08	5.86	8.95	2	1984
3	1984	10.00	12.23	5.90	11.34	6.13	9.45	3	1984
4	1984	11.70	11.05	6.31	11.29	5.82	10.83	4	1984
1	1985	9.84	10.69	6.33	7.75	5.83	9.12	1	1985
2	1985	10.40	10.73	6.30	8.41	6.39	12.36	2	1985
3	1985	9.33	10.20	6.29	7.06	5.68	11.97	3	1985
4	1985	8.75	9.62	6.31	7.07	4.69	11.01	4	1985
1	1986	9.24	8.95	7.36	7.05	4.83	11.17	1	1986
2	1986	10.19	8.31	5.47	6.36	4.54	10.74	2	1986
3	1986	8.59	7.24	4.64	6.09	4.60	9.30	3	1986
4	1986	8.35	7.08	4.71	5.20	4.50	9.69	4	1986
1	1987	8.24	7.98	4.40	5.49	4.81	10.65	1	1987
2	1987	6.80	7.96	3.99	5.72	3.99	9.32	2	1987
3	1987	8.29	8.33	3.71	5.82	3.70	8.76	3	1987
4	1987	9.35	7.98	3.77	6.59	3.99	9.77	4	1987
1	1988	8.41	8.60	3.90	5.73	3.65	8.21	1	1988
2	1988	8.53	8.04	3.82	5.98	3.39	8.30	2	1988
3	1988	9.19	7.39	3.82	6.57	3.89	9.03	3	1988
4	1988	10.33	7.99	4.15	7.17	4.96	11.39	4	1988
1	1989	10.94	8.47	4.16	8.07	5.33	12.51	1	1989
2	1989	12.14	9.16	4.20	8.82	6.62	12.39	2	1989
3	1989	12.08	8.99	4.46	8.15	6.96	13.62	3	1989
4	1989	12.23	9.35	4.88	7.75	7.36	13.44	4	1989
1	1990	12.23	10.47	5.59	8.44	8.18	15.08	1	1990
2	1990	12.69	11.02	6.20	8.24	8.36	15.19	2	1990
3	1990	13.51	9.97	6.77	8.33	8.30	15.11	3	1990

Exhibit 18: PERFORMANCE OF INVESTMENT OF $100

qtr end	year	Canada	France	Japan	USA	Germany	U.K.	qtr end	year
1	1980	101.30	92.34	97.87	103.19	91.08	101.36	1	1980
2	1980	108.64	104.32	115.21	107.45	102.94	115.17	2	1980
3	1980	109.78	104.54	121.71	109.66	102.35	121.07	3	1980
4	1980	110.37	99.86	130.71	112.64	96.69	125.47	4	1980
1	1981	114.71	93.34	128.21	116.23	92.05	122.83	1	1981
2	1981	117.78	83.37	122.14	120.19	83.54	109.55	2	1981
3	1981	122.41	89.42	120.58	124.97	88.69	104.60	3	1981
4	1981	130.44	90.18	129.85	129.93	94.08	114.73	4	1981
1	1982	130.39	86.05	117.73	133.81	90.16	111.03	1	1982
2	1982	128.58	81.49	116.11	138.33	90.59	111.83	2	1982
3	1982	139.70	80.86	111.35	143.08	90.14	112.27	3	1982
4	1982	144.93	88.69	129.87	146.75	97.78	109.89	4	1982
1	1983	147.91	84.54	129.64	149.83	97.31	103.25	1	1983
2	1983	151.80	82.90	131.59	152.98	94.13	109.64	2	1983
3	1983	153.92	81.44	135.62	156.39	91.90	109.72	3	1983
4	1983	155.40	80.46	140.10	159.94	90.32	108.90	4	1983
1	1984	154.49	86.62	147.05	163.68	96.49	110.77	1	1984
2	1984	152.60	83.32	141.18	167.65	91.05	106.11	2	1984
3	1984	156.45	78.93	138.55	172.22	85.05	100.14	3	1984
4	1984	160.42	78.43	137.55	176.88	82.90	95.21	4	1984
1	1985	158.75	81.85	138.90	180.22	85.58	104.59	1	1985
2	1985	163.72	84.95	143.05	183 89	87.83	112.20	2	1985
3	1985	165.91	99.48	166.63	187.05	102.08	124.85	3	1985
4	1985	166.21	109.75	183.13	190.28	112.01	132.13	4	1985
1	1986	169.95	118.86	208.10	193.55	120.37	139.50	1	1986
2	1986	175.46	123.35	229.55	196.55	128.30	147.44	2	1986
3	1986	178.88	132.91	249.40	199.48	141.17	142.84	3	1986
4	1986	183.58	139.31	243.71	202.02	148.49	148.06	4	1986
1	1987	197.79	151.84	267.59	204.74	161.79	166.54	1	1987
2	1987	197.03	152.33	272.38	207.61	161.00	169.28	2	1987
3	1987	204.18	156.04	277.14	210.56	162.91	177.30	3	1987
4	1987	210.95	180.60	328.18	213.95	189.37	207.35	4	1987
1	1988	226.94	175.49	327.70	216.95	182.45	209.56	1	1988
2	1988	236.45	164.06	313.91	220.12	167.99	195.84	2	1988
3	1988	239.04	159.96	307.75	223.65	163.90	195.89	3	1988
4	1988	251.17	172.51	335.13	227.56	176.10	218.39	4	1988
1	1989	252.99	167.87	320.15	232.02	168.11	209.62	1	1989
2	1989	264.47	166.41	302.64	236.97	166.66	201.95	2	1989
3	1989	276.22	172.62	302.80	241.66	171.55	212.59	3	1989
4	1989	288.82	196.83	304.21	246.21	196.71	219.95	4	1989
1	1990	292.77	202.25	283.58	251.25	197.90	228.02	1	1990
2	1990	305.60	215.45	297.44	256.27	208.74	258.11	2	1990

EXHIBIT 19

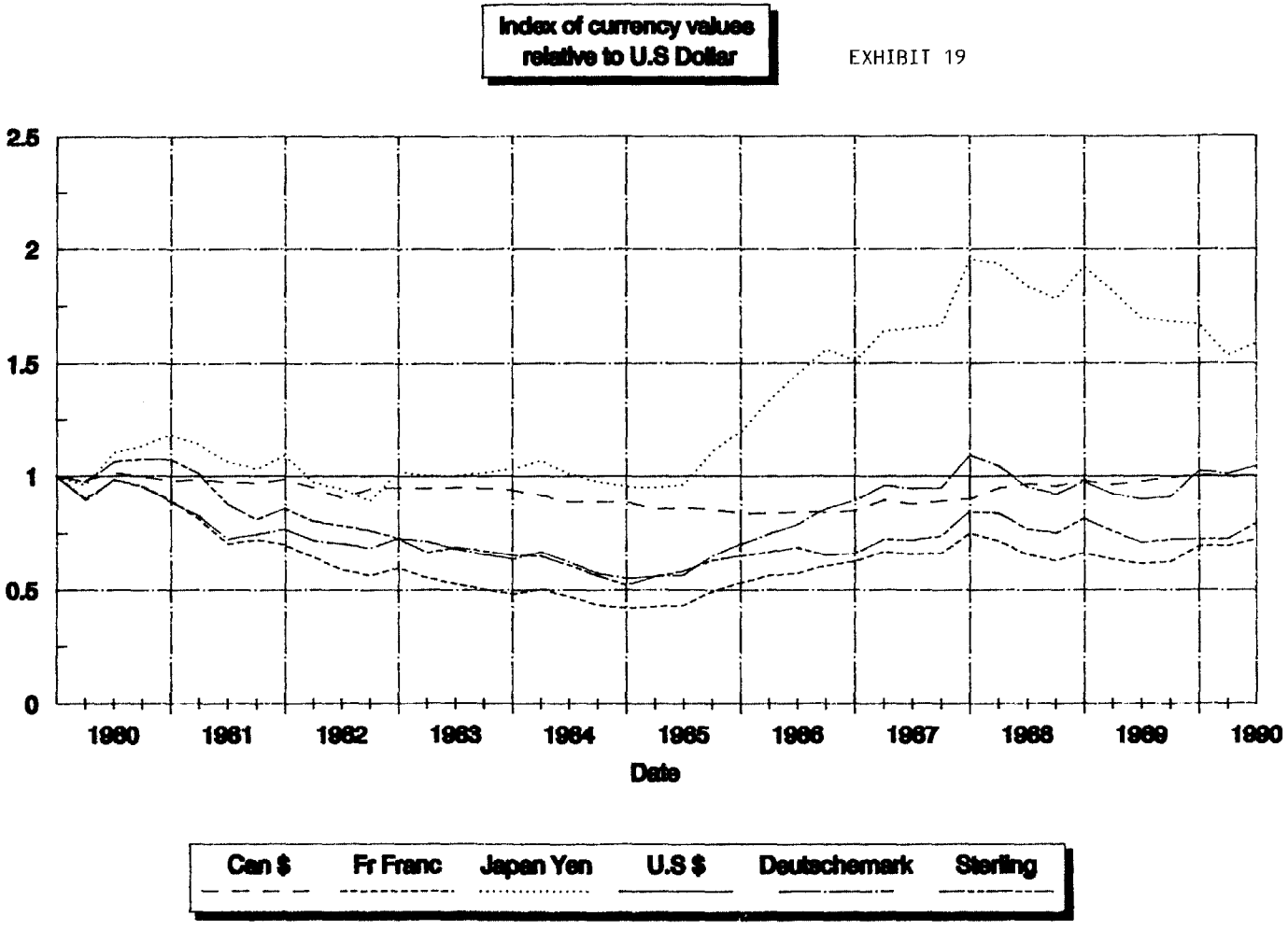
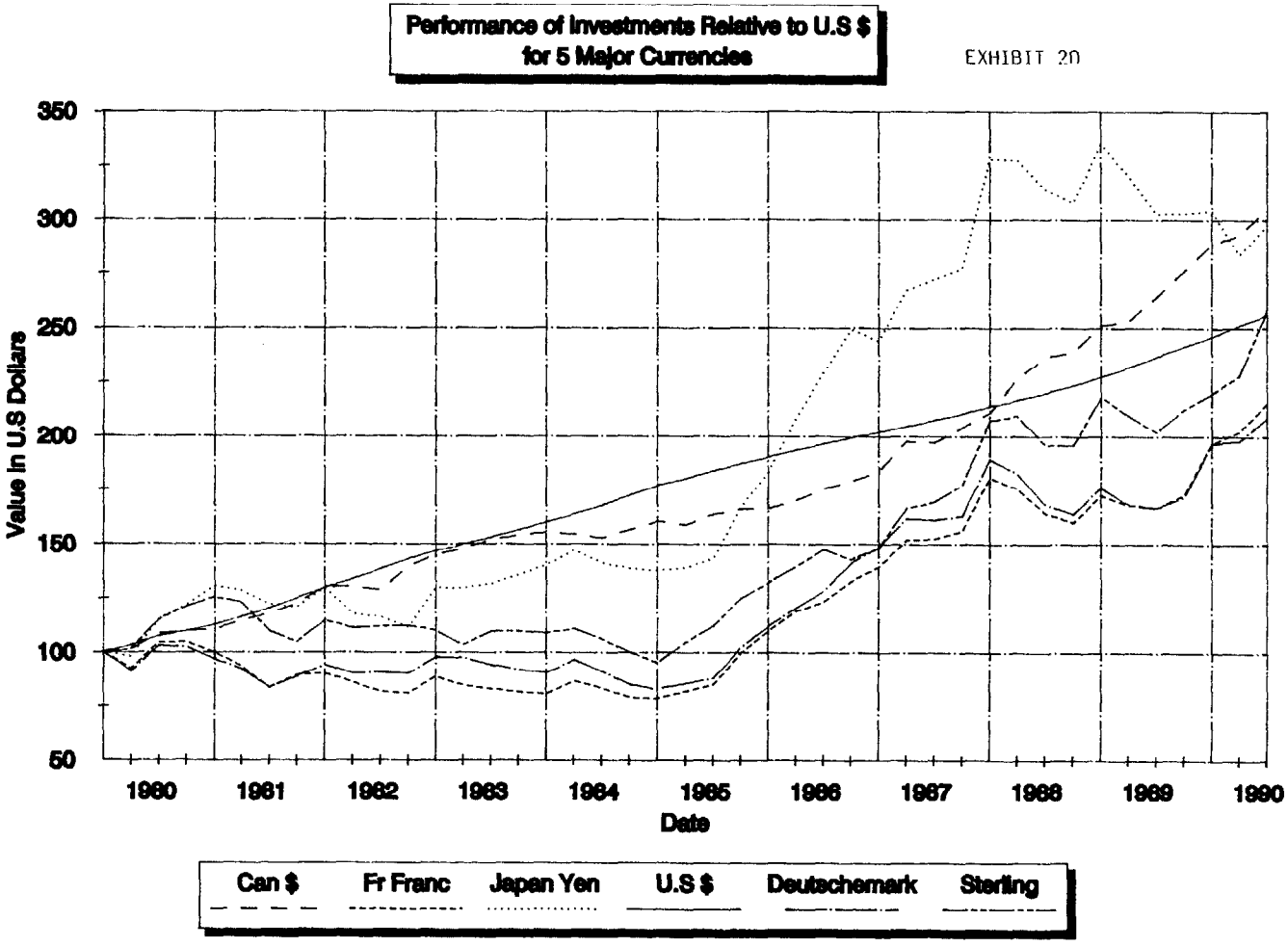

Index of currency values relative to U.S Dollar
2.5
2
1.5
1
0.5
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Date
Can $
Fr Franc
Japan Yen
U.S $
Deutschemark
Sterling

EXHIBIT 20


Performance of Investments Relative to U.S $ for 5 Major Currencies
Value In U.S Dollars
350
300
250
200
150
100
50
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Date
Can $
Fr Franc
Japan Yen
U.S $
Deutschemark
Sterling