

PART V REPORT
RAPPORT PARTIE V

Reinsurance of Mortgage Loan
Insurance in Canada

by Phelim P. Boyle February 1985

Reinsurance of Mortgage Loan
Insurance in Canada

Discussion Paper Prepared for the Program Evaluation
Division of the Canada Mortgage and Housing
Corporation

by

Phelim P. Boyle
Professor of Finance and Actuarial Science
University of Waterloo

February, 1985

COPYRIGHT - CMHC 1985

TABLE OF CONTENTS

1. INTRODUCTION
2. CONTRACT DESIGN: AN AGENCY THEORY PERSPECTIVE
3. REINSURANCE
 - 3.1 Introduction to Reinsurance
 - 3.2 Functions of Reinsurance
 - 3.3 Services Provided by Reinsurers
 - 3.4 Forms of Reinsurance
 - 3.5 Types of Reinsurance Contracts
4. COMMERCIAL REINSURANCE OF THE MORTGAGE DEFAULT RISK
5. PUBLIC REINSURANCE
 - 5.1 Public Reinsurance
 - 5.2 Public Reinsurance Targeted to Specific Groups
6. SUMMARY AND CONCLUSIONS
7. REFERENCES

1. INTRODUCTION

In recent years there has been considerable discussion concerning the role of government in relation to mortgage loan default insurance in Canada. Both the Matthews Report (1979) and the Economic Council of Canada (1982) have recommended that CMHC scale down its direct insurance activities in this area by gradually withdrawing from the direct provision of this type of insurance. Both these reports recommend that the government redefine its role in this area by providing reinsurance to private sector insurers operating in this field. The issue of public reinsurance in this context has also been discussed in the Assessment Report on Mortgage Loan Insurance (1984) published by the Program Evaluation Division of CMHC. At a one-day seminar in Ottawa in October 1984 sponsored by CMHC, there was considerable support for this concept. To date the discussion of public reinsurance has been extremely general. The aim of this paper is to discuss the concept of reinsurance in general and public reinsurance in particular in the context of mortgage default insurance so as to provide useful input to policymakers who will determine the government's future role in this area.

The whole issue of the role of government involvement in the mortgage loan default insurance area is a complex one with many facets. First it is difficult to construct an appropriate framework for policy evaluation. Second the existing public mortgage insurance program has been used to fulfill a multitude of objectives. Jones (1984) among others has suggested that public mortgage insurance may no longer be the appropriate vehicle for

meeting these objectives. The inclusion of social objectives in an insurance program of this nature can lead to conflicts with economic efficiency. The existence of conflicting objectives makes an evaluation of the role of public mortgage insurance difficult. It is also difficult to evaluate the impact of changes to the existing system. We do not have a good model of how the existing system functions and the various elements interact and so the consequences of making a significant change are difficult to predict. It is against this background that the present paper has been written.

The second section of the paper reviews some aspects of the theory of agency as it concerns risk sharing and incentives in a contractual setting. This analysis provides a useful conceptual framework for the subsequent analysis of reinsurance arrangements. Problems arising from informational asymmetry such as moral hazard and adverse selection are of particular importance in the context of risk sharing through insurance and reinsurance.

The third section of the paper describes what reinsurance is and discusses many of its characteristics. There is a fairly detailed description of the various functions of reinsurance especially its role in effecting risk sharing between the direct insurer and the reinsurer. Three important types of risk distributions are discussed which can give rise to particular types of adverse deviations that may endanger the solvency of a direct insurer. Apart from risk sharing, reinsurers often provide other services and a number of these are described as well, noting the distinction between how a commercial reinsurer and a public reinsurer might operate. The various types of reinsurance and the

different contract forms are analysed noting their risk sharing and incentive characteristics.

The fourth section of the paper discusses commercial reinsurance of the mortgage default risk in Canada. It is felt that this is a useful exercise even though the immediate prospects of obtaining private reinsurance for this type of risk in Canada are somewhat bleak given the poor financial experience of MICC in the last few years. However, with the premium restrictions removed and the possible withdrawal of CMHC as a direct insurer, this situation could change. Of particular interest is the recently arranged reinsurance treaty between the leading mortgage insurer in the United States and a syndicate of European reinsurers. There is a brief discussion of some of the details of this treaty.

In the fifth section there is a discussion of the role of public mortgage insurance in Canada. To focus the discussion, two - out of many - possible scenarios are analysed. Under the first CMHC gradually withdraws from the direct provision of default insurance and acts as a reinsurer to private sector insurers operating in Canada until they are able to obtain commercial reinsurance. Under this scenario there is no long-run role for public reinsurance: it is merely a temporary measure. Under a second scenario CMHC again withdraws from the direct market but provides reinsurance to the private sector insurers in respect of certain borrower groups or target areas. These would typically represent high risk groups who could well become unserved if CMHC withdrew from the direct market. Specific issues of contrast design and implementation are discussed. It should be emphasized

that these scenarios are meant to be illustrative rather than definitive. In particular, the contrast details and parameter values are meant to convey the general flavour of the arrangement rather than specific proposals.

The sixth section of this paper provides a summary and highlights some of the major conclusions.

In preparing this report I have benefited from discussions with mortgage insurers in the United States and Canada and from telephone discussions with reinsurers in a number of countries.

2. CONTRACT DESIGN: AN AGENCY THEORY PERSPECTIVE

A reinsurance contract is a risk sharing agreement between two parties, the direct insurer and reinsurer. The parties agree to fulfill certain obligations under certain conditions. For instance, if the direct insurer experiences claims above a certain level or of a certain type, it will submit satisfactory evidence to the reinsurer who in turn will pay the amount specified under the terms of the contract. While there is extensive descriptive and legal material on contract forms and a large volume of actuarial literature on premium computation, it has long been recognized that what one might term behavioural characteristics are of paramount importance here as elsewhere in contract design.

In general, two parties will only agree to form a contract or enter a relationship if both parties stand to gain from the relationship. For example, it would not be rational for an individual or insurance company to enter an agreement with the

knowledge that his expected welfare would decline as a result of the agreement. Welfare could be measured in terms of utility or satisfaction. By the same token, if two parties have entered an agreement and one party's welfare is being constantly and consistently reduced because of the arrangement, he or she will have an incentive to modify the terms of the agreement or perhaps even break the contract. Normally there are legal sanctions to the breaking of contractual arrangements. However, if we envisage a set of repeated contracts, then the disadvantaged party will strive to provide better terms and conditions when the next contract is being settled.

Within a given contracting agreement, especially in the insurance setting, it is unusual for both parties to have symmetric information regarding certain events which may trigger obligations under the contract terms. In some situations the economic consequences of a particular event may be partly random and partly under the control of one party. Generally speaking, it will be optimal to structure the contract design so that the party who can affect the outcome is rewarded for taking actions which are favourable to the other party and penalized for unfavourable actions. Even when the actions are unobservable, it can be shown (Boyle (1984a)) that contract designs can incorporate appropriate incentives. This type of situation is very pervasive. Thus we see sales representatives remunerated by commission or chief executives remunerated by common shares of their own corporations. In the case of insurance contracts, fire insurance premiums are reduced when sprinkler systems are installed. Incentives can and do alter behaviour and as we shall see this has important consequences for

the design of risk sharing agreements such as reinsurance contracts.

If the two parties to the agreement have almost identical objectives, then the need for incentives may be reduced. In those situations there is less scope for conflicts and in some situations, a very simple contract design or even a verbal agreement will be adequate. Conversely, if the parties have divergent objectives, then more attention needs to be paid to contract design and the monitoring of the arrangement. For example, in the current situation, it is clear that a public reinsurer (with some implicit if not explicit social objectives) will have different goals from a private sector direct insurer fuelled by the profit motive. Agency theory suggests that careful attention should be paid to the contracting arrangements in this situation.

Another aspect of information asymmetry which mitigates against efficient contracting is adverse selection. This topic is discussed in my earlier report (Boyle (1984b)). In the case of a direct insurer, adverse selection can occur when it offers a standard contract priced in terms of the average risk to a nonhomogeneous group. The more risky individuals will take out the contract and the less risky will attempt to signal their risk attributes in order to obtain a better deal elsewhere. This assumes the individuals have better information about their loss probabilities than the insurer. In the case of an insurer with a portfolio of risks, there is an incentive to reinsure just the riskier segments of its portfolio. Particular types of reinsurance contracts permit the insurer to reinsure selective parts of its portfolio or particular risks. In these cases, it is clear that a very full exchange of information is desirable to enable the reinsurer to obtain a clear picture of the risk offered to it by the direct writer.

As in other areas of commercial life the contracting process is facilitated if the two parties trust each other. Reinsurance used to be viewed as involving contracts between "gentlemen" with a high degree of mutual trust. This image has become somewhat tarnished in recent years but reinsurance contracts like insurance contracts are viewed in most jurisdictions as subject to the principle of "uberrimae fidei" - of utmost good faith. It is not enough for the parties to refrain from making misrepresentations, they have an obligation to disclose all the material facts. Some of the requirements of an efficient reinsurance arrangement can be given contractual force by spelling them out in detail in the "fine print" but often a revised contract or mutual trust and information exchange can be a more effective mechanism. Concerning the types of information exchange and relationships between the reinsurer and the reinsured, the following quotation from Carter (1979) is illustrative.

There must exist a high degree of mutual confidence between the two parties, and a willingness to cooperate in the running of the business, including prompt notification to the reinsurer of all claims and cooperation in their settlement. At inception the reinsurer will want as much information as possible regarding the nature of the business written by the reinsured, local conditions which may have a bearing on future loss experience, the reinsured's underwriting policy (including details of retentions, underlying reinsurances, etc.), and the experience and ability of the company's staff. All of that can be summed up simply in the duty of a prospective reinsured to comply fully with the principle of uberrima fides, and throughout the currency of the treaty to inform the reinsurer of any actual or proposed changes that may affect the results of the treaty. Some of the requirements of the reinsurer may be given contractual force by the insertion in the treaty of claims notification, change of underwriting policy, change of law, and similar clauses, and risks which the reinsurer regards as unacceptable may be excluded from the scope of the treaty.

Although the reinsurer has no direct relationship with the insured who is covered under the policy between the direct writer and the insured, the contracts effected between the reinsurer and the reinsured can impact on the relationships between the direct insurer and the insured. For example, if the reinsurance contract involves considerable risk sharing at the level of each individual risk, the direct insurer retains a strong incentive to reduce individual claim costs. This can be accomplished by: better underwriting; efficient contract design; the provision of appropriate incentives in the individual contracts; efficient adjustment of claims and claim settlement procedures. On the other hand, if the reinsurance agreement is based on the aggregate losses in the direct writer's portfolio and starts to pay when losses exceed a prespecified level, this could lead to an undesirable situation (from the reinsurer's perspective). If the reinsurance agreement, for example, guarantees the direct insurer a definite riskless profit from the outset, this might induce the direct writer to become careless about the experience of the original business. In some circumstances, an inappropriate degree of risk sharing between the direct insurer and the reinsurer may lead the direct insurer to expand his volume of business by taking on more risky individual policies. Normally this is viewed with apprehension by private reinsurers. In the current context of mortgage default insurance, it may well happen that these riskier contracts represent the very segments of the population that the government would like to provide assistance to through a mortgage loan insurance program. For example, they

may include mortgages on homes situated in one-industry towns or other borrowers who would normally be unserved without some form of subsidy. In these circumstances the considerations that would influence a private mortgage reinsurer would have to be analyzed rather carefully by a public reinsurer with specific social policy goals. If the public reinsurer is to function like a commercial private reinsurer, these policy goals would need to be attacked through some other mechanism.

3. REINSURANCE

In this section I describe some aspects of the reinsurance mechanism. First, I give a general overview of reinsurance and the functions of reinsurance. This part of the analysis is general but in view of the historical dominance of private reinsurance, I have commented on some of the specific aspects of public reinsurance. Second, I analyze the various types of reinsurance arrangements and contracts that have developed. The agency theory perspective developed in the previous section gives a useful framework for analyzing and interpreting the nature and form of existing reinsurance arrangements. In addition I discuss some of the other services in addition to risk sharing that can be provided by a reinsurer.

3.1 Introduction to Reinsurance

Reinsurance is a form of insurance and while there are many similarities between reinsurance and 'normal' insurance, there are important and significant differences. Under an insurance

contract one party, the insurer, agrees that upon the occurrence of an uncertain but specified event, he will pay a certain amount to the other party, the insured, in exchange for a definite payment, known as a premium. Under a reinsurance contract it is the insurer who pays the premium and the reinsurer who pays the claim should the event insured against take place. The following aspects of the distinctive nature of reinsurance contracts are noteworthy.¹

(i) While a contract of direct insurance is an agreement between an insurer and a member of the public, reinsurance contracts are contracts of insurance between two insurance companies, one known as the reinsurer, the other as the reinsured, the direct or primary insurer or the ceding company. A reinsurer may reinsure reinsurances it has accepted. In this case the contract is known as retrocession with the ceding company being the retrocedent and the reinsurer being the retrocessionaire.

(ii) While the direct insurer provides compensation against events which give rise to economic loss the reinsurer agrees to provide reimbursement to the direct insurer as prescribed under the terms and conditions of the reinsurance contract. The reinsurance contract is a separate contract between the reinsurer and the reinsured to which the original insured is not a party. It is therefore not an assignment of all or any of the rights and obligations existing under a contract of direct insurance.

¹ Much of this descriptive material is taken from Carter (1979) and Gerathewohl (1980).

(iii) While not all insurance contracts are subject to the principle of indemnity² all reinsurance contracts are contracts of indemnity. In practice most reinsurance contracts provide only for partial compensation, the reinsured absorbing part of the loss himself.

(iv) Although a lot of reinsurance business is domestic, there is also a very significant volume of business placed in the international market. By virtue of their huge domestic market, North American reinsurers represent some of the largest reinsurers in the world. In contrast, European reinsurers based principally in Germany, Switzerland and the United Kingdom, transact most of their business in the international market place. The state operated reinsurance companies in Russia and Eastern Europe spread their reinsurance throughout the world via the international market place. Historically, the international dimensions of reinsurance are not surprising given that the earliest contracts typically involved marine insurance. In recent times, an international reinsurer has

²Under a contract of indemnity, the insurer agrees to pay for no more than the actual loss suffered. The underlying rationale is that it would create inappropriate incentives if an insured could make a profit from an insurance contract which paid a claim in excess of the economic value of the object. This principle is found in the insurance legislation of most jurisdictions (Boyle, 1984b). Life insurance contracts are not contracts of indemnity because an insured's interest in his or her own life is deemed to be unlimited.

been able to obtain additional diversification by having a spread of business across different countries.³

3.2 Functions of Reinsurance

A reinsurer can supply a direct insurer with different services. These can be examined under the headings of

- (a) risk reduction services
- (b) other services.

To discuss risk reduction services, it is necessary to describe the types of risk that a direct writer may wish to have protection against. These include

(i) The risk of random fluctuations of the claims experience about its expected value.

(ii) The risk of an adverse change in the underlying distribution of claims. This may take the form of a change in either the frequency of claims, the severity of claims or both. For example, if the claims under an automobile insurance portfolio are sensitive to the inflation rate, an unanticipated increase

³Gerathewohl (1980, p. 49) gives a graphic example of international risk spreading in the reinsurance market. In 1956 the Italian passenger liner "Andrea Doria" perished with a total sum insured of US \$16 million. It was found that the original policy written by only Italian direct insurers had been distributed to over 300 insurance companies throughout the world. Consequently only about 10 percent of the claims were borne by the Italian market. Sixty percent had been reinsured in the UK and 30 percent in the USA. By way of retrocession these two markets had then redistributed the risk throughout the world.

in inflation will give rise to higher average claims. If driving conditions are unusually poor due to a prolonged bout of poor weather, the incidence of claims will tend to increase. In those cases there is a common risk factor which tends to affect all claims in the same direction.

(iii) This occurs where the risks are no longer uncorrelated as would be the case in flood insurance, unemployment insurance. In the context of mortgage loan insurance, this type of risk is known as macro-risk or catastrophic risk. The very existence of this risk raises questions about whether a given risk is or is not insurable.⁴

Each one of these three types of risk can threaten the solvency of a direct insurer as well as increase the volatility of his underwriting results. Reinsurance arrangements can reduce the risk of insolvency and stabilize the underwriting results. As a simple illustration of the type of risk envisaged by (i) consider the situation where an individual tosses ten fair coins. The probability of a head on any one toss is .5 or 50%. It would be viewed as a rather remarkable event if all the coins turned up heads. Even if eight or nine of them turned up heads, it would still be regarded as unusual. Because we know the statistical properties of the process generating the outcomes, we can construct a table showing the probabilities of attaining various numbers of heads.

⁴For some discussion of this point, see Boyle (1984b).

Table 1. Probabilities of obtaining various numbers of heads in tossing ten unbiased coins. Probability of heads for any one coin is .5

Number of Heads	Probability of Exactly this number of heads	Probability of Obtaining at least this number (i.e. this number or greater)
10	.000976	.000976
9	.009766	.010742
8	.043945	.054687
7	.117188	.171875
6	.205078	.376953
5	.246094	.623047
4	.205078	.828125
3	.117188	.945313
2	.043945	.989258
1	.009766	.999024
0	.000976	1.000000

Note that there is a 5.47% chance of obtaining 8 or more heads even where each coin is fair. If this idealized experiment corresponded to the situation of a direct insurer with the outcome heads denoting the insurable event and if the insurer had capital and premium income to ensure solvency provided there were no more than 7 claims (heads), there is a probability of insolvency of about 5.5%. By putting in place a reinsurance contract which pays all claims above the 7th, the direct insurer can get rid of this insolvency risk. However, if such a reinsurance contract is implemented, then there will be occasions when no claim is made under the reinsurance contract. The impact of the reinsurance contract will be to reduce the variability of the claims experience of the direct insurer. In most cases, it will also reduce the

expected profits of the direct insurer assuming the premiums charged by the reinsurer include a margin to cover risk taking and profit. Modern financial economics tells us there is a direct relationship between risk and expected return. The existence of the reinsurance contract generally serves to reduce the direct insurer's risk as well as his expected return.

To illustrate the second type of risk discussed above, suppose that the experience for several years had corresponded to individual claim probabilities of 50% and the insurer had ten independent contracts. If there is an overall increase in the claim probabilities so that the revised probabilities for a claim are .6 or 60% in each case then the portfolio probabilities are displayed in Table 2. Pursuing the simple statistical model introduced earlier, we now have a situation where the probability of heads for each coin is .6: the coins are all assumed to be biased.

Table 2: Probabilities of obtaining various numbers of heads in tossing ten coins where the probability of heads on any one toss is .6

	Probability of exactly this number of heads	Probability of obtaining at least this number (i.e. this number or greater)
10	.006047	.006047
9	.040311	.046358
8	.120932	.167290
7	.214991	.382281
6	.250823	.633104
5	.200658	.833762
4	.111477	.945239
3	.042467	.987706
2	.010617	.998323
1	.001573	.999896
0	.000104	1.000000

If the probabilities generating the claims correspond to Table 2, we see that there is now a 16.73% change of having eight claims or higher whereas in the case of Table 1, the corresponding probability was 5.47%. If there has been a true change in the underlying probability of claim occurrence from .5 to .6, reinsurance can only offer temporary and partial relief to this problem. The direct insurer will have to adjust his premiums to reflect this trend and the reinsurer will likewise tend to increase the reinsurance premiums to reflect the deterioration in claims experience.

In practice the process generating the claims experience is much more complicated than the highly simplified model used in these two examples. The underwriters will only have partial information on the factors which affect the risk. In addition, it is exceptionally difficult to distinguish between a random fluctuation and a change in trend. The above examples also assume that the risks are all homogeneous. In some lines of insurance, the sums insured can vary considerably within a given class of business. In this case the direct writer will be particularly concerned about the random occurrence of one or more large individual losses and may take special reinsurance measures to obtain protection against such an eventuality.

The third type of risk, the catastrophic risk, can have an even more dramatic impact on an insurer's solvency. In some circumstances, it can lead to the bankruptcy or to use the insurance term-ruin. To model this type of risk in the context of our simple coin tossing example, suppose that each time a different batch of ten coins is used for the experiment. The

mint produces these bundles and they are used without inspection or testing to simulate the results of each period's operations. The direct insurer computes his premiums and solvency margins on the basis that each bundle contains ten fair coins. Suppose that there is a flaw in the production process so that the bundles produced are distributed as follows.

Bundle Type	Characteristics	Percentage Produced
A	Contains ten unbiased (fair coins)	70%
B	Contains 7 coins with heads on each face and 3 fair coins	15%
C	Contains 7 coins with tails on each face and 3 fair coins	15%

On average the number of expected claims over the bundles is 5. However in the case that the tosses are made from a set drawn from bundle B, there is a very high probability of getting a large number of heads. The probabilities are displayed in Table 3.

Table 3: Probabilities of obtaining various numbers of heads in tossing ten coins of type B, i.e. 7 double-headed coins and 3 fair coins

	Probability of getting exactly this number of heads	Probability of obtaining at least this number (i.e. this number or greater)
10	.125000	.125000
9	.375000	.500000
8	.375000	.875000
7	.125000	1.000000
6	.000000	1.000000
5	.000000	1.000000
4	.000000	1.000000
3	.000000	1.000000
2	.000000	1.000000
1	.000000	1.000000
0	.000000	1.000000

Assuming that the direct insurer will be ruined if there are 8 or more claims, we see that this type of the scenario (where the ten coins are of type B) gives a probability of ruin of 87.5%. Clearly the insurer would be prudent to reinsure this type of risk assuming such reinsurance was obtainable at affordable prices. By the same token a reinsurer may be reluctant to underwrite this type of risk. The catastrophic risk faced by a mortgage insurer resembles this third type of risk. During a severe depression the frequency of claims increases and the average size of claim increases as well.

3.3 Services Provided by Reinsurers

In addition to its role in risk reduction, a commercial reinsurer can and often does provide a range of other services to a direct insurer. Some of these types of services may not be routinely provided by a government reinsurer but it is important to mention them in the present context. These services include both financial services as well as technical, statistical management and underwriting services.

In the context of the provision of financial services, the availability of reinsurance can increase the rate at which a direct insurer can expand its volume of business. If a minimum solvency standard is required by the supervisory authorities, then the existence of reinsurance enables a direct writer to write a larger volume of direct business than would be otherwise possible. It is not generally viewed as good insurance practice when a direct insurer retains only a small fraction of its own business. The one exception might be when a new small insurer is starting business with a small capital base to support risk taking activity.

In connection with the establishment of a new insurance company, a reinsurer may provide assistance in some or all of the following areas:

- establishment of the new company and licensing
- training of key personnel
- planning and product design
- setting contract terms and conditions
- calculation of premium rates
- advice concerning various management functions

As Gerathewohl (1980, p. 38) notes in recent years, reinsurers now are coming into closer contact with the original risk.

Another important service provided by reinsurers relates to the area of loss prevention and risk reduction. In some lines of business there is a trend for reinsurance companies to assemble specialized staff and sophisticated equipment to study loss prevention and risk reduction. This type of research can be applied to risks such as nuclear power stations, refineries, large chemical factories, etc. The advantage of having a reinsurer carry out this work lies in the economies of scale that can be achieved. While there is no obvious direct analogue in the case of mortgage reinsurance, one can certainly visualize the reinsurer employing experts who could be called when to give advice and assistance to a direct insurer. For example, the reinsurer might have expertise in underwriting that would be of assistance to the direct insurer. This is certainly the case in other lines of reinsurance. In fact, reinsurers may participate indirectly in loss prevention and risk prevention, risk assessment, premium rating and claims settlement. A reinsurer may have at its disposal experience and statistics from a large volume of business and this in turn can provide statistics and information to a particular direct insurer. Reinsurers can disseminate technical information through periodicals and research publications. The scope for such activities is more restricted in the mortgage insurance area especially if there is only one direct writer and a public

reinsurer. However, there is scope for some activities of this nature. One of the advantages of activities of this nature is that it provides for new channels of communication between the direct insurer and the reinsurer. Generally this improved communication is conducive to better business relationships. In some situations when the reinsurer trains staff of the direct writer, the relationship begins to assume some characteristics of a partnership.

3.4 Forms of Reinsurance

In this section I describe the main types of reinsurance arrangements and comment on their characteristics.

It is convenient to begin by describing the two principal forms of reinsurance. These differ with respect to the procedures used to place the reinsurance with the reinsurer and are known as

- (i) the facultative method
- (ii) the (obligatory) treaty method.

The distinguishing feature of the facultative method of reinsurance is that the arrangement is optional in the sense that the ceding company is not bound to transfer a given risk nor is the reinsurer bound to accept a given risk. Under the facultative method, the reinsurer will normally request a considerable amount of detail concerning the risks transferred so that it can monitor the underwriting and claims administration of the direct writer.

From the perspective of the reinsurer, the danger is that the direct writer will attempt to reinsure the more risky segments of its portfolio under the facultative method. By itself, this is not a problem provided the premiums charged are commensurate with the risk. If a direct writer continues to include the more risky segments of its portfolio and if the reinsurance premium is inadequate, this situation will not last too long with a commercial reinsurer. Either the reinsurance premiums will increase or the reinsurer will eventually decline to accept the business.

Some of these considerations are also relevant in the case of a government reinsurer. If the risks accepted by the reinsurer are not covered by the premiums received, then the reinsured is being subsidized. In the particular case of mortgage default insurance, the riskier contracts may well arise from one industry towns, and areas which are especially vulnerable to the consequences of an economic recession. It would be considered appropriate for the government to subsidize individuals in these areas. However, if the reinsurance contract takes all the risk away from the direct insurer, then the direct insurer may have an incentive to over-relax its underwriting standards and claims administration procedures.

In contrast to the facultative method, the risk transfer process is automatic under an obligatory reinsurance treaty. Once a treaty has been set up, the direct insurer can obtain reinsurance automatically for those risks that fall within the

terms and conditions of the treaty. Because of their automatic nature, treaties are cheaper to operate and administration procedures can be streamlined. From the perspective of the reinsurer, one disadvantage is that it has no control over the risks it reinsures. The long run profitability of the business will depend on the underwriting and claims administration skills of the direct writer. Although a government reinsurer does not necessarily have to operate at a profit, it can be argued that the profit motive impairs a worthwhile discipline to its operations. In this case the most effective way of ensuring a profitable treaty is to have the direct writing participate in the risk sharing.

In addition to facultative and obligatory treaty methods of placing reinsurance, there is a hybrid form which has aspects of both these methods. These are known as facultative obligatory. Under this arrangement the reinsurer agrees to automatically accept a portion of any business conforming to predetermined conditions with respect to class of insurance, type of risk, etc. However, there is no obligation on the direct insurer to offer any business. In this case the direct writer has the option whether or not to cede the business and so the possibility of adverse selection exists. Furthermore, there could be a problem if a claim arose before the ceding company had completed its reinsurance arrangements. Would this risk have passed to the reinsurer in the normal course of events? In the case of mortgage default insurance, presumably it normally takes some time for claims to occur after the loan is insured. However, it could well happen that the direct writer could attempt to

use this type of a method on a strategic regional basis to reflect potential adverse claims experience. From a commercial viewpoint this would be disadvantageous to a reinsurer.

3.5 Types of Reinsurance Contracts

There are a number of different types of reinsurance contract with distinctive risk sharing features. To classify these different contracts form, it is helpful to divide them into proportional reinsurance contracts and nonproportional reinsurance contracts. Under proportional reinsurance, the reinsurer accepts a fixed share or proportion of the liabilities assumed by the primary insurer. Thus for example, the risk might be apportioned on a 50-50 basis so that the reinsurer agrees to pay 50% of the claims in exchange for 50% of the premiums. Under a nonproportional reinsurance contract the reinsurer pays only if the claims experienced by the direct writer exceed a predetermined amount. For example, a normal insurance contract with a deductible is a form of nonproportional risk sharing. The insured meets all claims below the deductible and if claims exceed the deductible, then the insurer pays the excess. In purely mathematical terms, nonproportional insurance affords the direct insurer, the most efficient mechanism for risk reduction (Kahn (1962)), but as we shall see shortly, other important factors are relevant.

Both proportional and nonproportional reinsurance contracts can be further classified depending on whether the risk sharing effectively takes place at the individual risk level or the

portfolio level. Under quota share reinsurance, a fixed percentage of all risks accepted by the primary insurer are ceded to the reinsurer. For example, the recent treaty effected between MGIC and a syndicate of European reinsurers is of the quota share type. In this case 20% of each risk is reinsured and the payment to the reinsurance syndicate is 20% of the gross written premium less ceding commission. Effectively this means that 20% of the entire portfolio is reinsured. Under quota share reinsurance, the insurer will cede and the reinsurer will accept the predetermined share of every risk underwritten. The reinsurer participates directly and proportionally in the claims experience of the direct insurer and this induces an alignment of interests. Quota share contracts tend to be set up on an obligatory treaty basis.

The second type of proportional reinsurance is surplus reinsurance. It is like quota share reinsurance in that the direct writer transfers a certain share of each risk by paying an equivalent proportion of the gross premium (less reinsurance commission). The essential difference is that under surplus reinsurance arrangements, the direct insurer only reinsures that portion of the risk which exceeds its own retention.

Non proportional reinsurance can be classified based on whether the risk sharing takes place at the portfolio level or on a less global basis. At the aggregate portfolio level, non proportional reinsurance is known as stop loss reinsurance. A stop loss reinsurance consists of an arrangement whereby the reinsurer pays the aggregate claims experienced by the direct

writer in excess of a prespecified amount in any financial year. The prespecified amount is known as the priority point, or the attachment point or the stop loss limit. At first blush such a contract could be very desirable for the direct writer since it places an upper bound on the losses suffered in any one year. However, the premium required by the reinsurer may turn out to be very expensive or the cover required may be unavailable in the reinsurance market. Reinsurers often limit their liability by setting an upper limit on the amount of claims they will pay. In addition, the direct insurer may be required to share proportionally in the claim payments falling within the reinsurance limits. Gerathewohl (1980, p. 100) makes some relevant observations on stop loss contracts.

In terms of its structure, a stop loss cover seems to be the perfect form of reinsurance: Once the priority agreed on has been exceeded, the reinsurer becomes liable for the entire expenditure. Thus, the direct insurer will know in advance exactly what claims ratio he will have to pay for his retention if the worst comes to the worst. The only indefinite factors are the administration expenses and (with a variable stop loss premium depending on the actual claim experience) the price to pay for reinsurance.

However, this kind of cover (which may appear to be a panacea for the direct insurer) presents the reinsurer not only with physical, but also with substantial moral hazards. To reduce these hazards to an acceptable limit, one of the elementary principles of a stop loss cover is not to guarantee the direct insurer a profit. Indeed, if a stop loss were to offer such a guarantee, the direct insurer might lose interest in the experience of the original business and fail, for example, to introduce premium increases in time when the gross business starts generating a loss. Under such circumstances, a stop loss treaty would fail to fulfill a basic prerequisite of every insurance or reinsurance, i.e. to cover fortuitous, unknown losses. It would instead involve the reinsurer in an almost certain loss. The priority applied under a stop loss must be therefore always be fixed at such a level that the reinsurer will not become liable until the premiums retained by the direct insurer (as well as the interest earned) are not sufficient any more to cover the losses retained plus

the administration expenses. Assuming that the commissions and administration expenses of the direct insurer amount to 25 per cent and the net interest proceeds constitute 5 per cent of the gross premium, the stop loss priority would have to be above 80 per cent. When calculating that priority the reinsurer must also consider - particularly in times of inflation-related premium growth - that a premium increase due to inflated claims may at the same time bring about a reduction of the expense ratio if expenses do not increase at the same rate as claims. Under such circumstances a priority which was technically correct in one year and made the stop loss attach only when the direct insurer was already in the red, may become too low in one of the subsequent years due to a drop in the relative administration expenses: This could make the reinsurer become liable whilst the direct insurer is still in the black. To avoid such a situation it is advisable when determining the priority to allow a certain margin for future developments and to stipulate a figure a few percent above 100 including the expense ratio applicable at the time. Whenever revisions are then carried out annually, one should make sure whether the original margin is still correct.

Excess of loss reinsurance is like stop loss insurance but it operates on a less aggregated level. There are two ways in which excess of loss reinsurance can be set up. If it is arranged on a per risk basis then the direct insurer is protected against losses arising from an individual exposure unit in excess of a predetermined limit. This type of cover protects the insurer from a very large loss arising from a single exposure unit. An excess of loss over arranged on an occurrence basis protects the insurer from a single incident or event affecting several exposure units.

4. COMMERCIAL REINSURANCE OF MORTGAGE DEFAULT INSURANCE

Although the main objective of this paper is to study the rationale for and various aspects of public reinsurance of mortgage loan insurance, it is instructive to examine some of the considerations that would apply in the case of commercial reinsurance. This is because there will be some common characteristics. The potential conflicts between risk sharing and incentives that exist between a direct insurer and a reinsurer will be common to both arrangements. Of course there will be some distinctive differences as well. Another reason for examining reinsurance from a commercial perspective is that it is possible to have some form of partnership between a private reinsurer and a government reinsurer.

Perhaps the first point to note is that reinsurers tend to adopt a rather conservative attitude to this type of risk. This was confirmed in some telephone interviews I made recently with Canadian reinsurers. They were very wary of the catastrophic risks which could arise from this type of business. The current experience of CMHC's own insurance activity in this area and that of MICC reinforces the need for caution in this business. The standard reference book *On reinsurance* by Gerathewohl (1980) contains 2150 pages in 2 huge volumes. One page (547, Volume 2) is devoted to the mortgage loan default risk. He states:

The purpose of mortgage credit insurance is to protect the creditor under a mortgage loan against the event of the debtor being unable to repay the loan secured by the mortgage and of the proceeds from the forced sale of the mortgaged property not being sufficient to satisfy the

creditor's claim. The creditor is particularly exposed to such a risk if a mortgage loan is extended beyond the lending limits usually applied in financing real estate transactions. While companies transacting such business - e.g. mortgage banks, building societies, or insurance companies - are generally not allowed, by way of legal or supervisory restrictions, to grant mortgage loans in excess of such limits, lenders may do so if the excess share of a mortgage loan is secured sufficiently by an additional security, e.g. by a mortgage credit insurance.

The insurance of such "top mortgages" again involves various negative aspects for the credit insurer, as already referred to in the foregoing:

- The first problem is the long term of a mortgage loan of 10 to 15 years. It is very difficult if not impossible for an insurer to predict over such a long period the market price at which a piece of land can eventually be sold. Particularly in recent times experience in a number of countries has shown that the sale of real estate may fail to provide the anticipated proceeds. Since the assumption that real estate will constantly increase in market value has therefore proved to be wrong on various occasions, losses have been incurred on mortgage loans.

It is also difficult to judge the debtor's credit-worthiness over a long period. Although mortgages are based on the value of real estate, the assessment of a debtor's personal solvency and financial condition will also play an important role.

The insurer's main risk in mortgage credit insurance is not so much the possibility of an individual loss occurring from time to time, as the sums insured as such are relatively small. Rather, a great number of single losses must be expected to accumulate in times of economic depression and mass unemployment, thus producing an enormous aggregate loss as soon as a substantial share of the insurer's overall mortgage credit portfolio is in default.

- Second, the bank or building society, etc. lending a mortgage may proceed less thoroughly in examining the mortgagor's creditworthiness, since the loan is secured not only by the mortgage on the asset concerned but also, should such security be insufficient, by insurance.
- Last but not least, an insurer writing mortgage credit business assumes a risk arising out of a financial transaction, which enterprises habitually conducting such transactions are unable and often unwilling to assume.

For these reasons both credit insurers and reinsurers have a rather reserved attitude on mortgage credit business.

A commercial reinsurer contemplating this type of business would normally prefer the direct insurer to share the consequences of all of its underwriting decisions so as to minimize the scope for adverse selection by the insurer and to ensure that all claims are settled in an economic fashion. It seems likely that the reinsurer would prefer a quota share treaty arrangement. The direct insurer is still exposed to the adverse consequences of macro-risk but its exposure is reduced. The quota share reinsurance treaty can improve a company's solvency position and thus act as a substitute for additional capital.

It would appear that a direct insurer would prefer a facultative method of placing its reinsurance. It is known that certain areas are more liable to mortgage default such as one industry towns and regions whose economies are closely tied to a single product or resource. The direct insurer would like the freedom to reinsure these riskier portions of his portfolio. An alternative arrangement that might be attractive to the direct is a stop loss cover on the entire portfolio provided the premium charged was deemed reasonable. We have earlier mentioned some of the concerns that a reinsurer might have about such a stop loss arrangement. A reinsurer would be more than usually sensitive to these factors in view of the catastrophic risk potential of mortgage default insurance.

In recent weeks I have studied the somewhat limited amount of material available on the reinsurance of the mortgage default risk by the private sector and had discussions with insurers and reinsurers in both Canada and the United States. Both of the hypothesis advanced above were supported. The reinsurers

wanted "across the board" reinsurance to be placed so that the reinsurer would "follow the fortunes" of the experience of the direct insurer. A reinsurer would require to have some years experience of a direct insurer's management skills before departing from this type of risk sharing arrangement. On the other hand, the direct writers would like either selective reinsurance coverage or a stop loss arrangement with a "reasonable" premium.

Currently the leading private insurer in the United States, the Mortgage Guaranty Insurance Corporation, (MGIC) of Milwaukee Wisconsin, is completing arranging reinsurance with a syndicate of international reinsurers with Swiss Reinsurance, of Zurich, as the lead underwriter. Two treaties are being arranged. One is to solve the problems created by the separation of MGIC from its distressed parent, Baldwin United. The other is a quota share obligatory treaty arrangement with the reinsurers. As mentioned earlier, 80% of each risk is retained under the treaty and the treaty is cancellable by either party with a protection provision for existing reinsured business. Because of the regulations in the United States governing the insurance of mortgage default business, this reinsurance business would not be attractive to United States reinsurers. The inclusion of ten European reinsurers in the syndicate permits substantial international diversification through the reinsurance market.

It is important to note that the underwriting experience of MGIC in the last few years is significantly better than that

of MICC. The significance of this observation is that reinsurers like to see evidence of management skills reflected in a profitable record. With the benefit of hindsight, it is clear that MICC's premium levels have until recently been too low due to factors largely beyond their control. It would seem that at present MICC would find it exceptionally difficult to obtain reinsurance cover on the international market. However, this situation could change either as results improve or there is some form of governmental guarantee. At the present time, the prospects of arranging reinsurance cover are somewhat bleak. It could be contended that the recent placing of the MGIC business on the European reinsurance market will increase the acceptance of this type of risk. As against this the capacity of European reinsurers to underwrite this type of business in North America will have been reduced. It is not at all clear which effect will dominate.

5. PUBLIC REINSURANCE OF THE MORTGAGE DEFAULT RISK

The Canadian government could provide public reinsurance through CMHC or some similar body: alternatively it could provide implicit reinsurance by loan guarantees or other types of guarantees to MICC and presumably other private insurers. The evaluation of the role of public reinsurance hinges on the rationale for government involvement in the whole area of insuring the risk of mortgage default. Several recent papers have demonstrated that the stated objectives do not always conform to the realized objectives and that the objectives are often conflicting.

If the rationale involved is the existence of a market failure which cannot be resolved by market forces then the inability (here presumed) of MICC to obtain reinsurance in the private market place could be viewed as a signal for government action. (We leave aside the even more fundamental issue of whether any form of mortgage insurance is necessary, an issue which has been thoroughly debated in the recent discussion papers on this topic.) One could of course argue that the restrictions placed on the level of insurance premiums until recently has been a contributory factor in MICC's poor financial results in recent years. If this premise is accepted the objective of public reinsurance should be to restore MICC's solvency position and stabilize MICC's claims experience until it was able to obtain reinsurance cover in the private market.

Under this scenario there should be incentives for MICC to accelerate this rehabilitation. If the terms offered by the public reinsurance body are too attractive, there is no incentive for MICC to seek reinsurance at competitive rates. Under this scenario the public reinsurer should simulate the behaviour of a profit conscious private reinsurer. The reinsurance arrangement should be either a quota-share treaty with direct participation in each risk or a stop loss arrangement with limits on the reinsurer's total exposure. These might take the form of risk sharing on a proportional basis for those claims in excess of the attachment point. In addition there could be an upper limit in the total claims payable under the contract. This sort of restriction gives the direct insurer a strong incentive to be careful in its underwriting practices. It is possible to have different combinations of those arrangements but the best evidence that a direct insurer can meet the contract specifications likely to be found in the private market is to demonstrate that it has met similar standards under its existing reinsurance contracts.

From the perspective of economic efficiency there is no long run rationale for the continued existence of public reinsurance. Once private insurers are able to obtain reinsurance on the international market place, then there is little point in having government duplicate activities that can be carried on by the private sector. In fact, from a pure free market (or Chicago view) government involvement often reveals substantial failure to carry out the intended (or ostensible) purposes of intervention programmes at reasonable cost.

It may be difficult for a government agency to act like a private sector organization, and at the same time hasten its own demise. The

private insurers may lobby for arrangements like unlimited stop loss cover which could be provided by a government backed agency. Other pressures will stem from social objectives which often will conflict with those of sheer economic efficiency. That it is not to say that a public insurer could not respond to those objectives or grant coverage to the direct insurers not available in the market. If this happens, then the thrust towards efficiency that a market generates is blunted. The contract forms and mechanisms found in the private reinsurance market place have survived in Darwinian fashion because of their capability to resolve problems caused by the conflict between efficient risk sharing and the provision of incentives.

If a government organization is set up to provide reinsurance for mortgage default insurance, there will be very strong pressures to use it as an instrument of government social or economic policy. In the case of a public reinsurer, this will normally lead to some degree of conflict with the objectives of economic efficiency mentioned above.

5.2 Reinsurance Targeted to Specific Areas or Borrower Groups

Because of the nature of the mortgage loan default risk, certain borrowers will be classified as high risk. This may happen because of their place of residence, e.g. one industry town. Currently the provincial legislation in Alberta makes all loans there high risk because of the protection granted to a defaulting borrower. Assuming that CMHC gradually withdrew from the primary insurance market and took no action to provide coverage for these high risk groups, then assuming that there was still a private

insurance market, some of the following consequences might follow.

(i) The private sector insurer would increase premiums and tighten up underwriting and claims settlement procedures to better control the risk.

(ii) The private sector insurer might simply withdraw from these high risk areas.

These consequences would almost certainly have social and political repercussions. Let us concentrate on the high risk borrowers excluding the Alberta situation (which is really best resolved by the Alberta government). As it became more difficult to obtain mortgage insurance in these areas, there would be vocal political pressure to restore a benefit once seen to be provided by government. In particular, if scenario (ii) unfolded the pressure could become acute. A hasty government response would probably yield a rather ad-hoc and imperfect solution. It would seem preferable to prepare a more thoughtful course of action now rather than have a heavy handed one imposed later when the problem would be settled in reaction to political pressure. It is worth remarking that under prevailing conditions, borrowers in these high risk regions are being subsidized to a greater extent than other borrowers because the default insurance premiums are more or less flat across the board.

In order to cope with these high risk borrowers under a regime of public mortgage insurance, one could envisage an arrangement whereby only certain regions or target groups were reinsured. Assume that it is possible to specify these groups or regions accurately on an ex-ante basis. Say for example, they amount to 10% of a private mortgage insurer's portfolio. A stop loss insurance contract could be set up for these groups as a whole or a set of

excess of loss treaties could be arranged for the different sub-groups. As soon as claims exceeded the prespecified level, the public reinsurer would reimburse the direct insurer under the terms of the contract. It should be apparent from the earlier discussion that arrangements of this nature can be very dangerous for the reinsurer. In this case the fact that the reinsurer is a public reinsurer with presumed very deep pockets compounds the problem. The message from the earlier discussion is that great care must be exercised in drawing up such a contract. In particular, it is especially prudent to involve the direct writer in the risk sharing and give it incentives to adopt economical claims settlement procedures.

There are some explicit suggestions that can be made here. The direct insurer can be involved in the risk sharing by setting the priority point beyond the point where the direct insurer is losing money. Second, it would be advisable to have the reinsurer only pay a percentage of the claims in excess of the priority limit. For example, the reinsurer might pay 80 or 90% of claims above the priority limit. The priority limit might be set at 150 to 200% of the earned premiums obtained by the direct insurer in respect of the specific group of business. Because of the fact that the insurance contracts at the moment are single premium contracts, special provisions regarding cancellation or termination of the agreement would need to be included. The actual administrative mechanics of designing such an arrangement could be explored in depth at a later stage. The main point is that direct risk sharing by the primary insurer is very advisable. The private sector is probably more flexible in designing arrangements whereby lenders

can become more claim conscious, e.g. their use of option B. It would seem that MICC might also be willing to design the contract so that lenders participated in the risk sharing perhaps via a deductible in the primary contract.

Careful consideration needs to be given to the computation of premium levels under such an arrangement. Some general observations are in order. In the absence of regulations we would expect the premiums charged by direct insurers for these types of high risk contracts to increase above the average level of premium rates. In addition the actual quality of protection under the individual contracts in these areas will probably decline as contract terms and conditions are adjusted. The loss of protection would appear to present more of a problem for lenders than borrowers and we assume here lenders are capable of looking after their own interests. Why would one expect these adjustments? If CHMC withdraws from the direct market then although there is only one private insurer, I would expect premiums to move towards "market prices". Certainly there is no obvious reason why management of a private sector company would want to subsidize a particular group of policyholders. The appropriate premium to be charged for the reinsurance protection is difficult to determine. Suppose the economic or market premium for all risks is 2% and for high risks is 4%. Purely for sake of illustration, we might recommend a premium for the stop loss cover as being equal to the greater of

[one quarter of the gross premium]

and

$[\frac{1}{2} \text{ \%}]$.

A suitable range of these parameters could be estimated after reviewing historical experience and performing scenario simulations. It is not suggested that the figures quoted here are in any sense "correct" or final. Neither is the precise contract to be thought of as the only or best one. The reason for including the minimum premium is to ensure that the reinsurer receives a certain basic level of premium income.

In connection with the actual type of arrangement that might be eventually decided upon and the determination of its terms and conditions, one must remember that the final outcome will probably involve some sort of negotiation between the public reinsurer and the direct insurer(s). The terms suggested above have been written with the reinsurer's interests in mind. The private insurers will probably wish a more liberal set and there is clearly scope for negotiation. It seems very desirable for the representatives of the public reinsurer to have a clear view of the potential trouble spots that could arise and enter the negotiations with an appreciation of these problems in mind.

REFERENCES

Assessment Report, Mortgage Loan Insurance (1984): CMHC Program Evaluation Branch.

Boyle, P.P., Butterworth, J.E. and DeJong, P. (1984a): Models of Moral Hazard in Insurance and Finance. Transactions of the 22nd International Congress of Actuaries: Sydney, Australia: pp. 194-207.

Boyle, P.P. (1984b): Mortgage Loan Insurance; report prepared for CMHC, September, 1984.

Carter, R.L. (1979): REINSURANCE: Kluwer Publishing Limited, 1 Harlequin Avenue, Brentford, Middlesex, United Kingdom, TW8 9EW.

Gerathewohl, K. (1980): REINSURANCE PRINCIPLES AND PRACTICE: Vol. 1 and Vol. 2; Verlag Versicherungswirtschaft e. V. Karlsruhe; W. Germany.

Jones, L.D. (1984): Public Mortgage Insurance in Canada: its Relevance to the 1990's and beyond; report prepared for CMHC, October, 1984.

Intervention and Efficiency. Report prepared by the Economic Council of Canada, 1982.

The Matthews Report. Task force on Canada Mortgage and Housing Corporation, Report (Ottawa: CMHC).