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# Stabilising community health financing through re-insurance

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# Stabilising Community Health Financing Through Re-Insurance[1]

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Abstract: The purpose of this article is to examine the notion that reinsurance can stabilise the financial operation of small community based health schemes (micro-insurance) in low-income settings. Stabilisation activity focuses on counteracting adverse financial consequences of local catastrophes, the impact of excessive statistical fluctuations due to small group size, and the error in estimating probabilities of claims. A mathematical model was constructed to analyse the financial functioning of micro-insurance and its relationship with the reinsurer. Results were related to information from Kisiizi (Uganda). The main insight of the study is that when the financial results of the micro-insurance can be estimated, these schemes can be stabilised from the first year of establishing reinsurance treaties. The second insight is that the reinsurance might require several years of operation before reaching cost-neutrality.

Key words: *health insurance, re-insurance; low-income countries; health financing; modelling; community-based health schemes.*

## Introduction

The purpose of this article is to examine the notion that reinsurance[4] can serve as a tool to stabilize the financial operations of community-based health schemes in low-income settings. The fundamental idea proposed in this study is to view micro-insurance schemes as first-line insurers, and to elaborate a re-insurance facility to reduce their financial volatility. We propose to call this activity: "Social Re-insurance", or in short "**Social Re**".

Adequate assessment of the actuarial risk, and insuring risks through pooling are the "bread-and-butter" activities of the insurance industry. This is done by calculating the estimated normal cost and securing resources for worst-case scenarios. However, in order to stabilise the risk of loss or of insolvency, first-line insurers sign "treaties" with other insurance companies to reduce their own exposure to worst-case scenarios by re-insuring their risk portfolio. The part of the insurance portfolio that is transferred from one insurance company (the ceding insurer) to a second carrier (the re-insurer) is the reinsured portfolio. The part of the risk that is underwritten by the direct insurer is called the "retained" part.

Where governments provide a financial blanket to health schemes, the need for re-insurance may be obviated if risk management is replaced by financial injection from the government. Otherwise, one can discern - broadly speaking - two situations: application of risk

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[4] Insurers have three ways to restrict fluctuations in the results to remain within a given limit: self-restriction, co-insurance and re-insurance. Self-restriction means that the direct insurer restricts his own risk-acceptance limits to a low level, and only to risks that can contribute to portfolio homogeneity. Coinsurance is the name given to an agreement between competing insurers to divulge information and assume the same risk together. In practice, this raises problems of safeguarding the interests of the clients so that they should not suffer disadvantages form the coinsurance. Re-insurance is the method where insurers purchase cover for part of their risk; they can do so for many situations, e.g. a single large risk, protection against major variations in the loss experience of the entire portfolio.

management principles to health coverage, or considerable financial volatility. The former applies mainly to for-profit health insurers[5]. The latter situation is characteristic of community-based health plans[6], whose prevalence is steadily increasing in certain low- and middle-income countries (LMIC), and whose financial stabilisation is the focus of concern here.

The role of the community in developing health services has been recognised and encouraged in several international forums (e.g. the Bamako Initiative[7], the Social Summit[8], the Jakarta Declaration[9] etc.). Indeed, community involvement in health care has taken several forms[10]. Yet, according to recent studies, micro-insurance units (MIUs) operate with little or no legal and financial support from governments. They are financially[11] volatile due to low affiliation rates, low and irregular contributory capacity of the members, intense fluctuations in local conditions or an atypical burden of disease (Rainer on Burkina BOD, 2000). In fact, a comprehensive survey of 82 schemes claims that they usually survive only for as long as transfer payments from an external source can be secured (Bennett & Creese, 1998). Competition on outside resources[12] and lack of intrinsic capacity to organise financial transfers with other micro-insurance schemes has the effect that usually these schemes operate in isolation (WHR 2000, Budapest paper). Operating in isolation from other schemes means absence of opportunity to pool risks.

Reinsurance allows first-line (or "direct") insurers to free themselves from that part of a risk that exceeds their underwriting capacity, or to modify risk exposure and composition. In this way, losses can be balanced (or "homogenised") collectively over large groups that are united only through the re-insurance link. Reinsurance can also protect the financial resources of a direct insurer against larger-than-expected deviations in claims experience due to the risk of random fluctuations. In this way, reinsurance serves as an instrument to help ceding insurers reduce their probability of insolvency.

[5] For an analysis of the differences between private and social health insurance see Dror, 2000

[6] The term "micro-insurance" has been proposed to denote schemes whose main or only activity is to enhance access to health care, and who operate outside a national framework (for a detailed description see Dror & Jacquier, 1999). We propose to use the term micro-insurance here, and by analogy, the abbreviation micro-insurance unit (MIU) to refer to one such scheme, or MIUs to refer to many micro-insurance units (or schemes).

[7] WHO & UNICEF, 1987

[8] UN/ILO 1995

[9] WHO 1997

[10] Including the operation of revolving funds to pay mainly for "village medicine-chests", Tontine schemes that are more akin to savings than to insurance like the schemes in west Africa, schemes that are operated by micro-finance schemes as an extension into insurance activity (e.g. SEWA or FINCA Uganda) single schemes constituted on the basis of other self-help activities (e.g. the Engozi societies in Uganda) all the way to a network of community schemes operated under a government master-plan and enjoying some government support (e.g. Tanzania WB project, Uganda DfiD "reinsurance" plan for new schemes).

[11] In fact, the expression "financing" includes several separate issues, notably: willingness and ability of the insured to pay; structuring local resources into solvable demand; what supply (services) can this demand buy? If resources are insufficient, what other resources, including government spending, are allocated? And finally, the redistributive effect: what modalities operate to ensure that the external resources actually benefit the targeted individuals? These topics are dealt with in detail elsewhere.

[12] These outside sources are injected by a wide array of donors, both governmental (e.g. DANIDA, DfiD, USAID etc.) and NGOs. Some provide support through the government, while others provide support directly to single communities. Yet other donors, e.g. church organisations, help by covering the deficits of mission hospitals that provide services to members of micro-insurance schemes and non-affiliated people.

However, reinsurance does not provide absolute security against bankruptcy. The question of how much reinsurance to buy (i.e. how much of the risk to transfer to others) is a subjective judgement that depends on financial and other considerations, notably the willingness of the management to take risks[13]. The reinsurance company's task is to come as close as possible to the needs of the ceding insurer, without interfering with ethical choices inherent to the different role of the two insurers, while at the same time structuring and safeguarding the re-insurance portfolio.

The article sets out to consider the basic assumptions under which Social Re can provide re-insurance for MIUs. This requires a detailed analysis of the financial consequences of the specific context of micro-insurance. The article deals first with how the micro-insurance and the re-insurer can interact (Section 1). The MIU is presented in the form of a model, and the types of risks that can be reinsured are described. Section 2 deals with the unique features of the typical benefit package of MIUs, and introduces a distinction between "insurable" and "non-insurable" benefits. The topic of section 3 is recognising and overcoming the adverse impact of small group-size on financial stability. Methods to improve the assessment of risk probability in the specific context of micro-insurance are considered in section 4. Section 5 explores ways to finance the retained risk. And in section 6 the focus is on the ways in which Social Re can contribute to the financial stabilisation of micro-insurance schemes.

## <u>Section 1. The relationship between "Social Re" and the micro-insurance:</u>

The fundamental relationship between the re-insurer and a MIU is structured around the manner in which the former can stabilise the financial situation of the latter. For this purpose, the MIU must provide the re-insurer with a reliable distribution of its expected business results, to serve as the basis for the premium of the reinsurance. The reinsurer would wish to examine the veracity of the predicted distribution, without however bearing the responsibility for policy decisions leading to the business results. In its simplest form, the equation that expresses the operation of a financially viable MIU (without the premium for reinsurance) is:

Equation 1 $$I \quad TBE(t) + AC(t)$$

Where:

- I denotes Income (C*n + other income).
- C denotes members' Contributions
- n denotes the number of members of the MIU
  Income in the current time period reflects both income from members' contributions and other income (e.g. surplus carried over from previous periods, subsidies or external transfer payments etc.).
- TBE denotes Total Benefit Expenditure. TBE represents the aggregate costs of all incidences of B, within a given period t. The number of cases is only known with certainty at the end of each period, but TBE needs to be estimated at the beginning of the period in order to determine and collect the C upfront. Hence, projecting TBE would require an estimate (or an assumption) of the probability (P) and the average cost, as well as the expected fluctuations in these costs, for each type of B.

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[13] It has been claimed that setting retentions is more complex that calculating premiums or allocating reserves. For a detailed analysis of the theoretical considerations for a retention policy see: J. Friedlos, H. Schmitter, E. Straub: <u>Setting retentions – theoretical considerations</u>, 1997, Swiss Re, Zurich, 19 pp. (http://www.swissre.com)

B denotes Benefits; these are the costs generated by the types of treatment defined in the package.

AC denotes Administrative Costs. AC represents all the costs incurred in running the scheme that are not direct benefits.

t denotes the time unit representing the financial exercise (year or other)

Equation 1 may seem deceptively simple. However, the MIU may encounter four main obstacles in presenting the accounts: (i) obtaining reliable estimates of P; (ii) incoherent typology of risks that generate B, coupled with high variation in the value of B; (iii) determining C at a level that would reconcile an appropriate recovery level with the low contributory capacity of the population; (iv) the impact of statistical fluctuations on the actual financial outcome due to the small groups size of MIUs. These issues are explored in details in following sections.

*Methods of reinsurance*

The second feature fashioning the relationship between Social Re and the MIU is the specific method of reinsurance that would be used to stabilise the liability (or loss) of MIUs. This topic requires a definition of the needs of the MIU by reference to the options that the reinsurance industry offers. Two basic types of re-insurance are usually recognised: traditional and financial (or non-traditional).

The primary purpose of traditional re-insurance is the transfer of risk, under two types of contracts: *proportional (pro-rata)* and *non-proportional* contracts[14]. As its name implies, the first type covers a proportional part of the liability, which can be defined as part of the risk ("Quota share"), or part of outlier cost ("Surplus share"). The essential feature of non-proportional reinsurance is that the loss, not the liability originating from the original risk, is considered. Three types of calculation provide protection for different scenarios: protection against losses for one risk ("Per-risk excess", or WXL/R); or losses for a defined accumulation ("Catastrophic excess loss" or CatXL); or limitation of the aggregate claims-burden for any one year ("Aggregate excess" or "Stop Loss").

Non-traditional (or "financial") reinsurance[15] allows the insurer to balance financial shortfalls in bad years against surpluses set aside in good years. Non-traditional reinsurance differs from a conventional contingency reserve or savings-&-loan facility in that it views deficits and unachieved target surpluses as the same risk (which is: "financial under-performing relative to a pre-defined level"). This risk is insurable provided it is random and its probability known. Prior accumulation of reserves is therefore not necessary, allowing to cover even first-year deficits. Non-traditional reinsurance establishes a medium- to long-term basis within which the claims are balanced, through payment of high premiums in good years but low ones in years with bad financial outcomes.

Reinsurance contracts may be concluded either as "facultative re-insurance" (the cedent insurer chooses which part of the individual risks or the portfolio to offer for reinsurance) or as "obligatory re-insurance" (the relation between the cedent and the re-insurer is based on coverage of the entire portfolio). It seems that for the purpose of considering re-insurance of MIUs, the discussion can be limited to obligatory re-insurance.

[14] For a more detailed explanation of these methods see: Christoph Bugmann: Proportional and non-proportional reinsurance, The main differences between these two types or reinsurance cover – a discussion with specific examples, 1997, Swiss Re, Zurich, 33 pp. (Http://swissre.com)

[15] For more details please see: http://lifeandhealth.swissre.com/e/reinsurance/questions/index/financial.html

In all cases, the Social Re needs to collect a premium from the MIU for the reinsurance of risks. The premium may vary according to the nature of the risk, the estimated probability of the re-insured liability to occur[16] or alternatively – if the re-insurance covers losses rather than liabilities - the probability of loss, as well as the size of the portfolio that is reinsured. Whatever the method of re-insurance used and for any level of P, the MIU must have enough income to cover the share of the claims it underwrites itself. This requires maintaining a reliable accounting system. The respective shares of the MIU and the re-insurance in assuming the risk are determined in the contract (or "treaty") between the two sides. In analogy to equation 1 for MIUs, Social Re will be solvent as long as total premium income from ceded risk will suffice to cover the cost of all claims submitted, plus administrative costs. In its simplest form the equation for this would be:

Equation 2

$$\sum_{n=1}^{k} PR_{n,t} \geq \sum_{n=1}^{k} R_{n,t} \cdot \overline{Cl}_n + AC(t)$$

Where:

k denotes the number of MIUs pooled by Social Re.

$PR_{n,t}$ denotes the premium paid by any MIU n to Social Re in period (t).

$R_{n,t}$ denotes the risk that MIU n will present a claim to Social Re in period (t).

$\overline{Cl}_n$ denotes the average claim that will be presented by MIU n. This need not be an arithmetic average, but may be a weighted average combining risk estimates for different claims[17].

AC (t) denotes the administrative costs of Social Re in period (t).

The above equation can be solved when the values of $R_n$ and of $Cl_n$ (as well as AC) are known. This presents a considerable challenge, in that the first two parameters depend on the financial performance of each ceding MIU. Regardless of the type of re-insurance treaty that would apply in each case, Social Re can assess its risk (and hence determine the premium it needs to charge) only on the basis of the financial results and other information that originate from the MIU.

*Modelling the relations between Social Re and a micro-insurance unit.*

The relationship between the MIU and the Social Re is, for the time being, inexistent in reality. In order to describe it and the assumptions underlying this relationship, a mathematical model[18] was constructed. The model assumes that a MIU consists of a limited number of members (n), who are affiliated for the entirety of a defined period (t). The period of membership is normally identical to the period of the financial exercise, (e.g. annual). It is assumed that the probability of risk is independent of the period, of past events of the same

[16] Cost of the events times its probability

[17] For instance, if the MIU has 100 members, and the probability is 10%, this parameter will be calculated bearing in mind that in reality the distribution of claims will follow the binomial law. Similarly, when the benefit package includes several events, each carrying a different probability, the weighted average can be calculated to aggregate the probability of the entire package.

[18] Cichon et al. (1999) describe the scope and focus of modelling of health care financing in the following words: "Models usually attempt to translate complex observations into simpler images in order to better understand reality. A financial model usually maps the observed financial structure of the system and projects this structure into the future, or simulates the effect of a change in a selected parameter or parameters". But whereas the focus in the quoted book was on financing of the national health care delivery systems or sub-systems, the focus here is on micro-insurance schemes.

risk and/or of other health risks and that it distributes according to the binomial law [19]. The relationship between the MIU and each of its members is expressed through two parameters: The contribution amount[20] (C) and the benefit amount[21] (B). Also, the model presumes a uniform probability for all members to claim a benefit; this assumption is an expression of the solidarity-basis of MIUs. Hence, the direct insurer opts to disregard individual risk for the purpose of setting the contributions. This is equally true at the point of entry and at any other subsequent period. The level of C is directly related to the probability (P) of the risk that generates B. The MIU can reduce its exposure to the financial consequences of a high P by limiting the value of B[22] (e.g. setting a maximum reimbursable amount per case, or a maximal number of claims per period and per member, such as: only one delivery reimbursed per calendar year). Last, the model includes a parameter to account for administrative costs (AC). The model accommodates three ways to express these costs: fixed, claim-related, and related to the number of members (or a combination of all three).

The model provides an algorithm to calculate the risk of insolvency for a defined level of C due to statistical fluctuations. For this, the values of P, B and n must be known or estimated. The mathematical model is annexed (Annex I).

## Section 2: A typology of the benefit package

*Non-standard structure of the package*

The benefit package in most high-income national schemes covers every type of care that is not specifically excluded or limited; but under the rules of MIUs each unit needs to choose which benefits to include, as only those benefits that are specifically included are covered.

The first option might be to base the choice on epidemiological and demographic profiles. However, often these data are neither easily available nor necessarily reliable in many LMIC[23]. True, Global Burden of Disease descriptors are available, but according to a recent study conducted in sub-Saharan Africa, there may be significant differences between the GBOD and locally measured burden of disease (BOD) for the same region, reflecting heterogeneous conditions[24]. Past utilisation levels must also be questioned; these may reflect as much the diagnostic capacity of local medical attendants than a correct range of needs. As in many rural areas diagnostic knowledge may at times be limited to a narrow range of prevalent illnesses (in their acute and severe stage), to accidents and to maternity complications, future utilisation changes could reflect changes in the diagnostic knowledge of local medical personnel as much as real changes in the BOD.

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[19] In practice, a correlation may be observed between certain benefits, which should be taken into account in the application of the model to specific situations.

[20] It is assumed that one amount of contribution per period can cover one person or a pre-defined family unit.

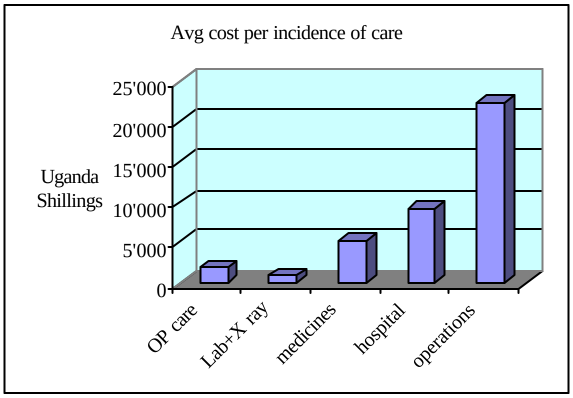
[21] The benefit represents an expenditure generated by certain types of events that are included in the benefit package. The benefit is expressed in monetary terms in the model.

[22] Qualifying conditions have an impact on the calculation of the value of B (and hence also on C), but are not treated as a separate parameter in the model.

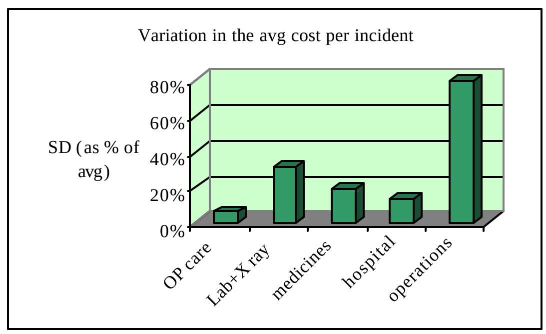
[23] Kaufman et al.: *The absence of adult mortality data for sub-Saharan Africa: a practical solution*, Bull. World Health Org 1997 (75/5:389-95)

[24] Ralph Würthwein, Adjima Gbangou, Rainer Sauerborn, Christoph Schmidt: Measuring the local burden of disease – a study of years of life lost in rural Burkina Faso, 2000, Ruprecht-Karls-Univesität Heidelberg, Discussion paper 1/2000, 17 pp.

Another approach might be to set priorities from among available services. In large and well-financed health systems, the package includes a wide range of preventive, curative and rehabilitative care, triggered by events that vary in their frequency, randomness and elasticity. In contrast, MIUs can provide a more limited package that reflects lower resources, simpler facilities (infrastructure and technology) and limited clinical expertise and drug supply. Data from the sole hospital centre in Kisiizi region (Uganda), serving 30 MIUs (a total of 929 families, estimated to represent some 4,000 individuals) was used to illustrate this situation [25]. This data lists all forms of care given during 9 months; the authors catalogued entries by the treatments rather than by the cause. The authors grouped this data into five main categories. The figure below shows the average cost for each type of treatment. As can be seen in figure 1, outpatient care costs on average US$ 1.25, whereas medicines cost 2.8 times more (US$ 3.52), a hospital stay costs on average 5 times the price of OP (US$ 6.16) and surgery 12 times the price of OP care (US$ 14.98)[26]. However, the data also shows that different MIUs paid a different average cost for these benefits, probably due to medical conditions rather than differential pricing. The variation in the cost per incident is shown in figure 2.




This variation suggests that using average costs to predict typical future expenses may be inaccurate for a single period or a single MIU, in particular for those benefits where the variation from the average is substantial. As can be seen in figure 2, the standard deviation for surgery (the most expensive benefit) was 79.5%, and the variation for medico-technical services of 31.2%.




It should be recalled that the expenditure pattern of a MIU would be determined by the price per benefit type multiplied by the frequency of claims for that type. The frequency of claims by benefit type was also calculated for this same example. It turns out that the frequency of surgery was 176 times lower than that of OP care. On the other hand, as can be expected, the frequency of prescriptions was very similar to that of OP care. However, comparable frequency does not imply comparable cost; for instance, although OP and medicines have similar frequency, their relative shares of the cost is very different. The *ex-post-facto* composition of average benefit expenditure for the 30 MIUs in the Kisiizi example is shown in the pie chart (figure 3). This snapshot of the composition of the expenditure can be juxtaposed to the fundamental assumptions on the benefit package. It confirms the assumption that pooling of resources, even at this level of income and in such a small population, can improve the ability to cope with high priority needs for care. It is particularly interesting to note that the two most costly benefit types (surgery and hospitalisation) represent only 1 and

[25] The authors collected the data during an exploration mission to Kampala, Kisoro, Kisiizi and Ishaka regions, Uganda, in April 2000. The data reflects 8 months, from August 1999 to March 2000

[26] The prices in Ugandan Shillings are: OP care 1868.01; Lab + X ray 888.40;medicines 5, 284; hospital 9,237.17; surgery 22,467.06. (US$ 1 = U. Shillings 1,500) Source: Kisiizi Hospital data for 1999.

12 percent respectively of the total expenditure. Where even a single incidence of surgery (and maybe also hospitalisation) could have had a devastating effect on a single household, or even on a single MIU, if it needed to pay for the care directly, the Kisiizi example shows that these risks could be covered within the pool of MIUs without excessive financial exposure. In fact, some MIUs in areas adjacent to Kisiizi that operated outside a pool shied away from covering hospitalisation or surgery because of fear of the potential catastrophic effect of bad years, although it was known (and affirmed by the authors in interviews) that potential members would join only if these services would be covered.

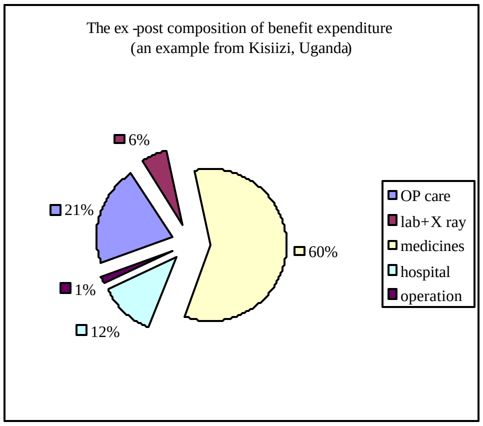



Figure 3 also illustrates that the expenditure pattern in MIUs seems atypical in comparison to most well financed health schemes. On the one hand the expenditure for medicines is about 3 –4 times larger, and on the other hand the share of medico-technical benefits, hospitalisation and surgery is much lower. These differences may be partly due to the high cost of imported drugs relative to local resources, and the focus on emergency rather than elective hospital care. Rural MIUs that do not cover referrals to secondary or tertiary care may present yet another atypical benefit package[27].

The atypical benefit package implies that local financial information cannot be extrapolated from large health schemes; instead, this information must be obtained in its particular context.

The next stage in the interaction between the MIU and a reinsurer would be the decision which part of its package to retain and which to cede to reinsurance. In parallel, the reinsurer would have to decide which risks to accept.

*Distinguishing between "reinsurable" and "non-reinsurable" events*

Reinsurance business operates on the tenets of insurance theory; therefore, benefits that would be ceded must satisfy these principles. Insurance theory is based on the notion that it is economically viable, under certain conditions, to replace a definite but affordable cost for an indefinite but much higher cost. The conditions that must be met are that the event has to be random and has not yet occurred, it needs to be identifiable, measurable, and one that would not be speculative or generating a profit from ill health ("socially beneficial", i.e. representing a public good). Also, the premium needs to be affordable.

A brief juxtaposition of some common benefits included in most health insurance schemes leads to the deduction that these rules are not always respected. For instance, expenditure for preventive care, or for the medical infrastructure (health centres, laboratories, medical equipment, buying a "village medicine chest etc.) is planned and deliberate. Another example would be treatment of known existing or chronic conditions, e.g. the cost of insulin treatment is ongoing for diagnosed diabetes cases. More generally, events and costs that are planned and

[27] A distinction needs to be made between rural MIUs operating where there is no or low supply of health services and MIUs that operate in urban areas where there may be some competition between providers. The former need to organise their own delivery capacity, whereas the latter could act as purchasers of services for all their members.

known in advance cannot be insured, and even less so ceded to reinsurance. Such cost must be regarded as "non-insurable".

Examples of random costs include treatment for snakebites or appendectomy. They represent inelastic demand. Such costs are clearly "insurable" and reinsurable.

However, many situations may be less clear-cut: For instance, the probability for amputations in the population in general is lower than the conditional probability among diabetics. Nevertheless, amputations are random for both sub-groups, and the risk of moral hazard is low. The cost can therefore be insured, even if premiums must take into account the ratio of diabetics in the insured population. Likewise, malaria transmission through a mosquito bite is random; attack of a malaria-carrier is also random, but the probability is higher than that in the general population. The cost of treating a malaria attack is also variable[28]. These examples differ from straightforward "insurable" costs only in their P. On the other hand, some medical conditions require comfort- rather than vital treatment; for example, a migraine attack is random, but treatment is elastic. Cost of care would depend on affordability. Such costs can in principle be ceded to reinsurance, but the premium may be too high for the MIU.

Two clarifications are called for:

- Characterising a cost as "non-insurable" does not imply that the service need not be provided, or that it is less important than those associated with "insurable" costs. The only implication of this categorisation is how the cost should be financed, and whether it can be reinsured.

- Although the use of the terms "insurable" and "non-insurable" could imply a dichotomy, in practice there is a grey area reflecting ranges of probabilities, elasticity and subjective priorities. The classification of specific events as "insurable" or "non-insurable" would depend on policy choices.

*Dissimilar financing arrangements for the two types of events*

A simple aggregation of insurable and non-insurable costs may expose MIUs to certain market failures (adverse selection, moral hazard and other inefficiencies), may distort priorities and - worst of all - expose them to a higher risk of insolvency.

The costs related to insurable events can be handled as straightforward insurance business, and as such they can be reinsured.

Costs generated by non-insurable events cannot satisfy the conditions of reinsurance. Hence, a different approach may be necessary. Inelastic costs would require a steady source of financing. On the other hand, costs generated by elastic demand could be financed from a variable source, e.g. surpluses29.

The distinction between insurable and non-insurable costs has been included in the model, in order to take note of the different financing mechanisms. Also, for non-insurable costs, two options have been retained: a fixed and a variable financial allocation.

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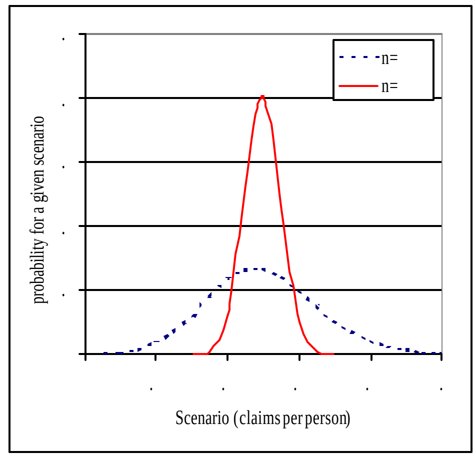
[28] In the data from Uganda, the range for malaria treatment was min: 750 and max 12,9130 (a factor of 1 to 172)!

[29] Using surpluses is a simple option if the MIU is reinsured for a large part of its risk portfolio. On the other hand, a MIU that is not reinsured may have to keep surpluses as a contingency for years when it has a deficit.

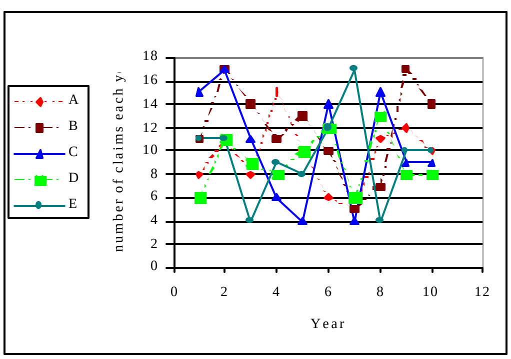
In summary, it has been shown that both epidemiological and socio-economic reasons accentuate benefit-package heterogeneity. Even if most benefit packages include seemingly identical items, the content, utilisation patterns and cost related to such items may vary largely between MIUs. Secondly, identification of insurable and non-insurable benefits permits to identify the part of the portfolio that can be ceded to reinsurance. This distinction may also be instrumental in prioritising and financing selected non-insurable events.

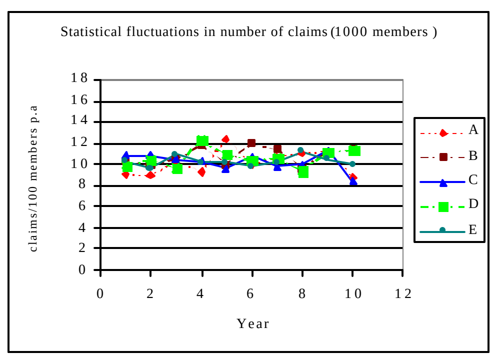
**Section 3: <u>Impact of group size</u>**

Group-size plays an important role in assessing the financial viability of MIUs. The linkage between group-size and occurrence distribution is a statistical axiom. It has little or no significance in groups exceeding a few thousand people, which explains why this issue is normally not raised in reference to national schemes. But in the context of MIUs this issue is significant because the typical size ranges between 100 and 1000 paying members, i.e. small membership. In the example from Uganda, the numbers range from 15 families to 57 families, (each family is estimated to include 4 individuals).



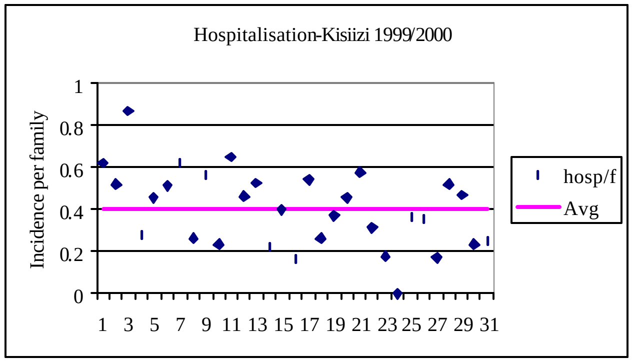

Small groups are more exposed to insolvency, both because of the potentially stronger impact of local catastrophes and because of the higher exposure of small groups to statistical fluctuations in the actual number of claims. An illustration of the different distribution around the average number of claims is provided in figure 4, in a claim/non-claim simulated scenario[30], comparing two groups that differ only in size (100 vs. 1,000 members), with P=10%. The same scenario was simulated for five MIUs over 10 years. Figure 5a plots 5 groups of 100 members each, and figure 5b shows the results for 5 groups of 1000 members. These twin figures illustrate clearly that (i) Over time, the actual number of claims is expected to regress to an average value (in




[30] The Excel random number generator was used to generate the number of claims according to the binomial distribution

the example it is 0.1 claims per insured person); (ii) However, statistical fluctuations around this average are much more pronounced for small group; (iii) In each particular year, small MIUs will experience very significant variance in the actual number of claims (by a factor of 2-3); this is visible both by comparing two units at any one given year[31] and in looking at the same unit across different years[32]. Furthermore, these variations are independent of demographic and epidemiological parameters, as the simulated values were identical for all MIUs. As can be seen in figure 5, one MIU may experience higher-than-average claims during several consecutive years, which can cause it to default on its financial obligations, or even go bankrupt. Such a failure can occur even if contribution income is sufficiently high, and independently of any catastrophic incident. Similar fluctuations were observed in the incidence of hospitalisation of 30 MIUs in Uganda over 9 months (figure 6). The same pattern has also been noted for four other benefits. The similarity between simulated results and real life in this case strengthens the notion that simulations can be used to assess the effect of various parameters. Another lesson is that short-term observations of any one MIU cannot serve as a reliable estimate of the average number of claims, and thus of P.




## Section 4: Assessing risk-exposure of the direct insurer

It has been suggested earlier that national data cannot serve as a reliable source to extrapolate the risk or cost structure of MIUs, because of profound epidemiological and socio-economic differences between the two settings. It has also been shown that observations of the experience of single MIUs over short periods of time could lead to considerable error due to large statistical fluctuations. However, insurance activity is based on the analysis of risk and cost data. In fact, the level of the premium is directly related to the probability of an event, its fluctuations and its cost. MIUs need to assess these parameters even in the absence of reliable quantitative data, both in order to fix their contributions and in order to provide Social Re with estimates of their balance. Two questions arise: how to estimate the probability and what is the consequence of error in the estimate.

*Assessment of probabilities*

When reliable quantitative records are unavailable, it is possible to base risk estimates on subjective assessments of probability form local experts. There is a technique to process such expert-advice[33]. Bayes' Theorem provides a protocol according to which experts interact with each other anonymously (to avoid the difficulties typical to face-to-face meetings) and re-examine their initial probability assessments in light of the responses of the group as a whole

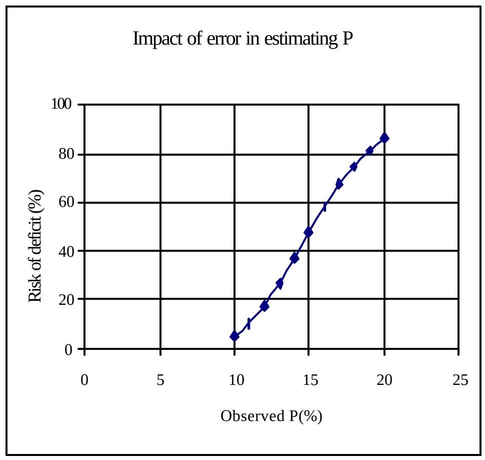
[31] E.g. a range of 4 versus 21 claims in year 9
[32] E.g. compare years 9 and 10 for unit C
[33] For instance, if the decision-maker feels that a particular expert consistently underestimates the probability of an event, the probabilities received from this expert might be corrected by a known factor or the information given by the experts could be weighted according to the past performance. We then note which outcome actually occurred.

(usually a two-round survey technique). The purpose is to converge towards stable values for key variables. This is known as the Delphi method[34], which provides a way to compute revised *post hoc* probabilities when prior probabilities are unknown[35]. The Delphi technique can often produce answers surprisingly close to realty and can easily be associated with the use of triangular distributions. The triangular distributions rank among the simplest and most effective ways of extracting data from an expert or a panel of experts if the number of possible answers is broad and the best estimate is uncertain.

A Delphi technique can begin at any state of an assessment. If prior information is available from sample evidence in a large health system, it could be combined with a Delphi approach to estimate the deviation between the large health system and a specific MIU, despite the basic differences between the two. An alternative point of departure for the Delphi technique could also be information obtained from a single MIU over a relatively short time.

*Consequence of error in estimating P*

The mathematical model described in section 1 was used to examine the impact of error in the assessment of P on the financial outcome of a MIU. The calculation was made for a hypothetical MIU of 100 members and for one risk with P=10%. The contribution level was calculated to cover 95 percent of all possible statistical scenarios. The model was then used to examine the consequence of an underestimation of P, by calculating the risk of insolvency for higher values of P (all else remaining unchanged). The results of this calculation are shown in Figure 7. The figure illustrates the considerable financial impact of error in estimating the value of P: At the left end of the graph the initial situation is shown (n=100, P=10%, the risk of failure=5%). But if P turns out to be 15% rather than 10%, the risk of deficit rises from 5% to 48%; and if P is really 20% rather than 10%, there is 86% likelihood to incur a deficit, instead of the expected 5%! Both the average number of claims and statistical fluctuations will increase with P. It is self-evident that as more and better data becomes available, the estimate of P should improve. The higher uncertainty during the first years should be factored into the treaty between the Social Re and the MIU.




## Section 5: Financing the retained risk

Every health insurance scheme must secure sufficient resources to pay claims arising out of risks it retains. In this, large schemes and MIUs accept a similar obligation towards their

[34] Delphi is not a polling procedure in a strict scientific sense; rather, it is a special communication technique. It has repeatedly demonstrated its potential to get people thinking in new ways so that the product of the entire group's effort is valuable to all the contributors.

[35] Each hypothesis is assigned a "prior probability" (between 0 and 1); in the absence of a prior basis for assigning probabilities, one can spread a "belief probability" evenly among the hypotheses. Then a list of possible observable outcomes is constructed. This list should also be mutually exclusive and all-inclusive. For each hypothesis the "conditional probability" (the probability of observing each outcome if that particular hypothesis is true) is calculated, and the sum of the conditional probabilities for all the outcomes must add up to 1. For more information on Bayes Theorem please see http://hometown.aol.com/johnp71/javastat.html

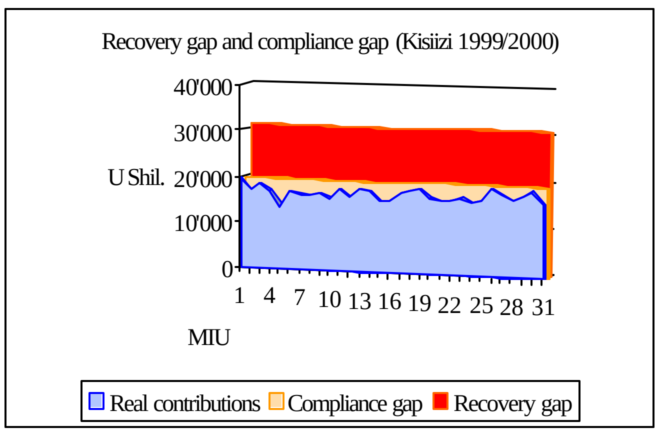
members. However, whereas MIUs are exposed to the risk of the adverse impact of statistical fluctuations, large schemes are shielded from it due to their sheer size. MIUs can fend off this risk by reinsuring above-average claim load. This distribution of responsibilities for financing the operations between MIUs and Social Re is the essential definition of stabilisation. Stabilisation means rectifying the specific elements that destabilise MIUs. The acid test for successful stabilisation is that members of MIUs would pay the same contribution as would be charged for the identical package in a large scheme. Stabilisation of the financing of MIUs is the role of Social Re.

When large schemes calculate the income they need to meet their financial obligations, they use average expenditure as a benchmark. The same should be true for stabilised MIUs.

However, contributions may be set too low. The measure for this is a gap between expected income and the average cost of care ("recovery gap"). The recovery gap may indicate demand-side expectations to increase benefits without corresponding increases of the income side, or providers' behaviour (supply-induced moral hazard and monopolistic pricing, where there is little or no competition between suppliers), or the prevalence of a pandemic (e.g. HIV-AIDS), or inflationary pressures, or the inability of the population to pay the necessary level.

Another problem with the financing of retained risk is the difference between real and expected contribution income ("compliance gap"). The compliance gap may indicate deficient capacity of the MIU to collect contributions as fully as possible, but also cyclical and irregular income patterns of the insured population.

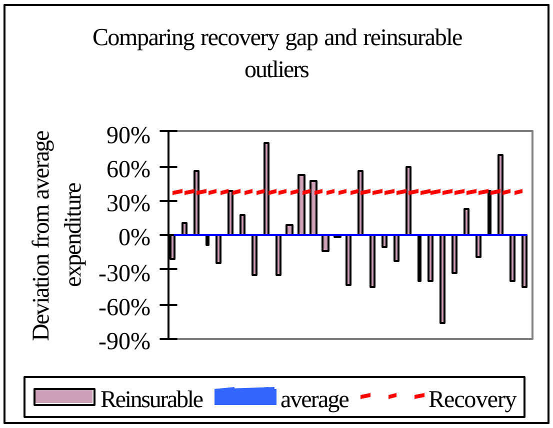
The compliance and recovery gaps have been calculated for the Uganda case study, and are shown in figure 8. In this example, the compliance gap is on average 12.5 percent, with values for single MIUs ranging from 0% (best payer) to 29% (worst payer). The recovery gap represents 37.5 percent of average expenditure; and if both the recovery and the compliance gaps are cumulated, the income shortfall reaches 45.3 percent.



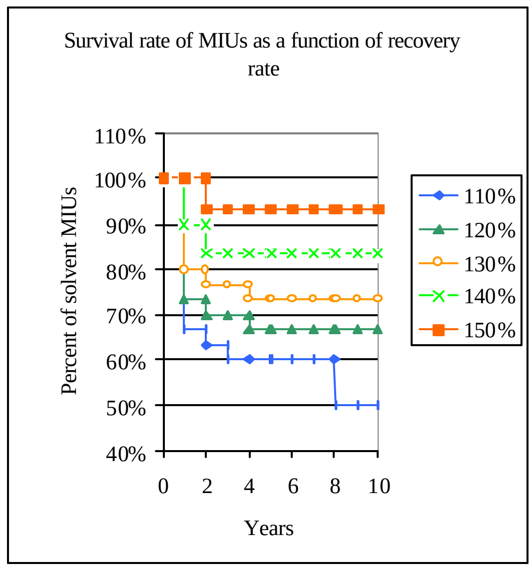

The recovery gap cannot be reinsured, as it is not random. Thus a financing source must be found to close it.

## Section 6: <u>Options to stabilise the financing of MIUs through Social Re</u>

When the recovery gap is significant, the question might arise whether stabilising fluctuations through Social Re would make a substantial difference to the financial performance of MIUs. The answer depends on the relative magnitude of the recovery gap and the fluctuations. Both parameters are context-specific, yet the fluctuations are an intrinsic characteristic whereas the recovery gap can be resolved through a policy choice. An insight into the relative magnitude of both in a real-life situation was obtained from the Uganda data. Figure 9 depicts the deviation of real expenditure of each MIU from the average. The excess expenditure of seven out of 30 MIUs was larger than the recovery gap. Consequently, flattening expenditure fluctuations through reinsurance would have been more important for these MIUs during that financial exercise than a subsidy that would have closed their recovery gap.




The argument was explored further, in a simulation that measured how long MIUs[36] could remain solvent without reinsurance, when their contributions were at levels higher than 100% of the recovery rate[37]. The results are shown in Figure 10. Only fifty percent survived a ten-year period when their recovery rate was 110%. As can be expected, survival rates increased with increasing recovery rates. But only those MIUs that could secure an income of 150% of the recovery rate for the entire ten-year period were almost safe from insolvency. Sustaining such a high-income level for long periods of time is however unlikely. In particular, when the same level of survival can be secured by reinsuring outlier costs for a lower price.




It has been shown earlier that MIUs suffer destabilisation from (i) the impact of excessive statistical fluctuations, both of the incidence and of the cost of benefits, due to small group size (it should be recalled that by definition, random fluctuations stem solely from the insurable component of the benefit package); (ii) risks of error in estimating probabilities due to the atypical composition of the benefit package and insufficient reliable data; and (iii) high exposure to financial consequences of local catastrophes.

Reinsurance solution for the risk of error in P and the risk of catastrophes would have to be elaborated on the basis of context-specific data. On the other hand, reinsurance solutions aiming to reduce the impact of statistical fluctuations can be discussed in a general way.

Stabilisation through Social Re can occur in several ways. First, Social Re can replace the need to create and replenish contingency reserves from start-up (before the MIU has accumulated any surplus), by stepping in and paying deficits in bad years, while recuperating such losses from surpluses of MIUs in good years. This is based on the view that financial underperformance, compared to a pre-defined business result, can be considered as random risk, which should in the long term balance itself out. This general statement does not apply to the impact of catastrophes, which can be reinsured separately. The pre-defined business outcome can be "no-profit-no-loss" or it can be a different level, notably a defined surplus (to ensure growth potential or to pay for variable non-insurable costs). To operate this form of

[36] The profiles of the 30 MIUs are identical to those used in the previous simulations.
[37] Recovery rate=100-recovery gap

reinsurance, the MIU would have to pay a premium to the Social Re every year, but this premium would be low in bad years and high in good years. Since this form of reinsurance focuses on the overall business result, its operation requires very rigorous accounting of income and expenditure, including a record of the compliance and recovery gaps, which would be excluded from reinsurance in all cases.

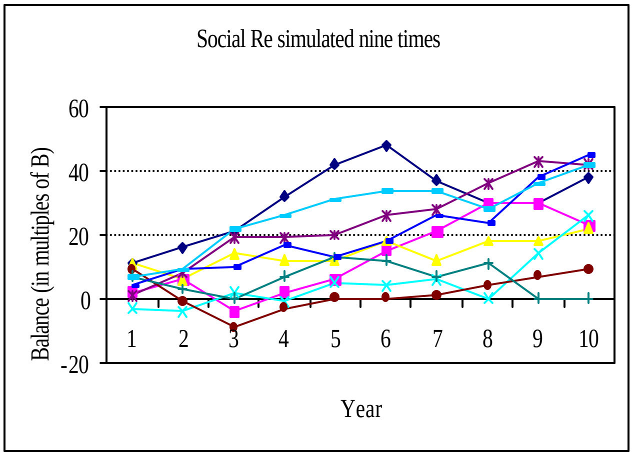
A completely different approach to stabilising the risk would be reinsuring loss or liability of one or more specific benefit type. Each benefit can be characterised by its incidence, its cost and the variability of this cost. The resultant business considerations of these parameters shall be illustrated next, using the Kisiizi data.

Benefit type: OP Care. The incidence is relatively high (3.52 episodes per family on average), with cost of 1868 U.Shill that is fairly constant (standard deviation = 5.9%, see figure 2). The likely source of loss here is outlier incidence, and thus the reinsurance solution might be to cover incidence above a pre-defined level, e.g. above 4 episodes per family per period.

Benefit type: medico-technical costs (Lab + X ray). The average incidence was 2 per family; the average cost was 888.40 U.Shill. per incident, with variability of 31%. In this case, both the price and the incidence fluctuate, i.e. the MIU can incur losses either due to high incidence or because of the need for more costly procedure, or both. The solution for this scenario might be to cover expenses exceeding a certain monetary level, e.g. anything above the average cost per family (1,776.80 U. Shill.), regardless of its cause.

Benefit type: Surgery. At 0.02 episodes per family, incidence level is very low; at 22,467 U. Shill., the average cost per incidence is very high; and with a standard deviation of 80%, this cost is very variable. With this profile, it is more meaningful to look at the outlier case rather than at the averages. Looking at the Kisiizi example, the cost of the most expensive surgery was 43,740, a hundred times higher than the average cost per family (449.34). This single surgery accounted for 71% of the total expenditure of the MIU. This example points to the risk that one member can bankrupt an entire MIU. Hence, the reinsurance solution should refer to the type of benefit. It should be recalled that by having paid their contributions, the members of the MIU have already paid the average cost of this benefit. Hence, the MIU could cede this benefit in full.

All the above examples dealt with a share of the loss. An alternative option would be to reinsure a proportion of the liability, rather than truncating the loss.




Any reinsurance solution rests upon the condition that Social Re can remain cost-neutral in the long-term. The analytical equations describing this scenario, when multiple MIUs are reinsured over several years, are too complex for a mathematical solution. Instead, two simple scenarios were simulated: Social Re covering 5 MIUs (run 18 times) or 10 MIUs (run 9 times). Each MIU had 100 members, with P = 0.1 per person per year and one benefit B. Total income was assumed to be equal to 100% recovery rate plus 1.5B. The treaty, lasting 10 years, fixed the premium at 1.5B and in return Social Re paid for all claims above the expected long-term average (10B in this example). The simulated financial results of reinsuring 10 MIUs are shown in figure 11. It can be seen that during the first five years, episodes of deficit are possible although not very likely. After five years, Social Re breaks even in all nine runs of the simulation. The results of reinsuring only 5 MIUs show that 3 out of 18 runs had a negative balance after 10 years (data not shown). This simulation confirms that Social Re stands a better chance of cost neutrality if it pools a larger group of MIUs, but in any case can remain cost neutral in the long term.

## Concluding remarks

The main insight offered by this study is that reinsurance can stabilise the long-term financial operation of MIUs. In fact, Social Re can stabilise MIUs from the first year of establishing reinsurance treaties. On the other hand, Social Re might require several years of operation before reaching cost-neutrality. The premiums it collects and the number of MIUs whose risks it pools will in large part determine the length of the period it needs itself to be financially sound.

Another conclusion is that stabilisation must be differentiated from financing. The objectives of Social Re and the MIUs are thus clearly distinct. Social Re aims to create the financial environment that will enable MIUs to operate under conditions comparable to large health schemes. MIUs aim to offer a package at a favourable cost/benefit ratio. Implementing these objectives oblige MIUs to secure funds to cover the average expected costs, while Social Re will cover outlier costs for affordable premiums.

An underlying requirement for the relationship between Social Re and the MIUs is that the latter should provide a reliable account of their business results as well as information on the risk they underwrite. Social Re needs financial and risk information in order to assess the probability of insolvency of MIUs, and set premiums accordingly.

Launching the operation of Social Re would require a considerable effort in establishing the information base. Existing conditions under which MIUs operate today would need to be improved in terms of the material infrastructure and the knowledge base for data collection, validation, audit and analysis. This process will take time.

In addition to the direct stabilising effect of reinsurance activity, Social Re may contribute indirectly to a change in the composition of the benefit package. For example, if Social Re were to pay for surgery, one cannot exclude that the providers would introduce more surgical procedures; the level of P for this benefit type would thus increase, and with it the premium of Social Re. Such changes would require periodic reassessment of contributions to MIUs and premiums to Social Re.

Lastly, a clear distinction between stabilisation and financing, and improved quantitative information on the operation of micro-insurance schemes could enhance their credibility among both donors and the target population.

Annex 1: The model

## References

(Will be provided later)