ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. 41, pp. 132–144, 2013

0305-750X/$ - see front matter

http://dx.doi.org/10.1016/j.worlddev.2012.05.028

Pricing in Microinsurance Markets

CHRISTIAN BIENER *
University of St. Gallen, Switzerland

Summary. — Microinsurance markets have exhibited strong growth rates in recent years. Great parts of the industry are, however, challenged by fundamental issues of providing insurance products, one of the most significant of which is pricing risk. In this paper, we provide a nontechnical analysis of insurance pricing problems and a review of the set of opportunities that can address some of the specific pricing constraints in microinsurance markets. A key contribution of this paper is the investigation of conventional techniques as potential solutions for improving the pricing of insurance risk in microinsurance markets.

Key words — developing countries, microinsurance, data availability, actuarial pricing, credibility methods

1. INTRODUCTION

This paper provides a nontechnical analysis of insurance pricing problems and reviews the set of opportunities to address some of the specific pricing constraints in microinsurance markets. We thus strive to provide a basic understanding of conventional techniques which are rarely used in microinsurance markets today. Microinsurance is defined as a financial arrangement intended to protect low-income people against specific perils in exchange for regular premium payments proportionate to the likelihood and cost of the risk involved (see Churchill, 2007). Despite strong growth rates (see Churchill & McCord, 2012), these markets exhibit considerable limitations in terms of sound insurance practices, one of the most significant of which is pricing risk. To a large degree, this problem is due to constraints on data availability and a lack of utilizing suitable actuarial approaches.

The problem described here is not unique to microinsurance; however, it is especially pronounced and severely distorts the development of these markets. Constraints on data availability require microinsurers to make restrictive assumptions on the risks to be insured. The resulting estimates for expected losses thus require adjusting for potential adverse deviations through loadings (see Wipf & Garand, 2006). Those loadings can be substantial in microinsurance markets, making insurance unaffordable by the target population (see, e.g., Dror & Armstrong, 2006; Linnerooth-Bayer *et al.,* 2009). In certain cases, premiums are subsidized and set on the basis that they will not exceed the target population's willingness to pay (see, e.g., Vaté & Dror, 2002). This practice exposes microinsurers either to substantial risk of insolvency due to underpricing risk (see, e.g., Dror & Armstrong, 2006), or, in case of subsidization, leads to an unsustainable business model since subsidies are typically only temporarily available. Increased precision in premium setting would allow microinsurers to reduce loadings and, consequently, increase their ability to offer more competitive prices (see, e.g., Brown & Churchill, 2000). Current practices put at risk confidence in a developing market if resulting in microinsurers not having sufficient capital to settle insured losses or if premiums exceed the target population's willingness to pay. Thus, to create and promote a sustainable microinsurance industry, it is necessary to design products that offer both a low risk of insolvency and affordability by the target population.

In this paper, we analyze the problems of pricing insurance risk in microinsurance markets and investigate the appropriateness of standard approaches and current practice. We consider both the supply and the demand side of the market. In our discussion, the supply side is represented by the determination of a technical premium; the demand side covers its marketability, and interactions between the availability of microinsurance coverage and individual behavior. The integration of both perspectives is an important aspect of this paper, since we often observe a large gap between the technical premium and the customers' willingness to pay (see, e.g., Churchill, 2007; Linnerooth-Bayer *et al.,* 2009). Despite the growing interest in microinsurance, very few studies offer guidance on pricing in these markets given their specific challenges. [1]

Current research confirms significant problems in pricing risk in microinsurance markets (see, e.g., Biener & Eling, 2012; Dlugolecki, 2008), whereas data availability is a prevalent challenge. Meaningful premium estimates, however, cannot be derived without a minimum of reliable data. Whereas internal loss data most appropriate for pricing most risks are often not available, microinsurers have access to informational sources that allow making inferences on risk properties. The use of ad hoc methods such as surveys and the inclusion of expert experience through, e.g., Delphi methods, can increase the accuracy of pricing insurance risk. We discuss the application of transition approaches that aim at adapting risk patterns from regions that have more data to the region of interest.

Credibility models can be valuable in making use of various sources of information, synthesizing risk characteristics into a technical premium, and providing means for updating premiums over time. Bootstrap techniques bypass a severe disadvantage in microinsurance markets: estimating the robustness of pricing estimators from small samples of original loss data, by creating new data. The application of risk management strategies provide further means to adapt to the environment of microinsurance markets and decrease excessive risk-loadings that are prevalent in the presence of data restrictions.

* The author is grateful to Martin Eling, Nihar Jangle, Sebastian Marek, Mary Yang, Hans-Joachim Zwiesler, and the participants of the *ASTIN & AFIR Colloquia 2011* in Madrid, the *Contemporary Microfinance: Institutions, Policies, and Performance* conference 2011 in Cairo, and the *2012 Microinsurance Conference* in Enschede for helpful comments and suggestions. Final revision accepted: May 25, 2012.

This paper's main contribution is its investigation of potential approaches for a more accurate pricing of insurance risk in microinsurance markets. The focus of the paper is on the estimation of technical premiums, i.e., the minimum premium an insurer needs to charge for a specific insurance policy to be viable. We also include the interaction of premiums with demand and behavior to discuss possible explanations of the discrepancy between technical and market premiums in microinsurance markets and provide potential solutions.

The industry investigated in this paper—microinsurance—is still in its infancy, but has huge future potential. We analyze the specifics of pricing risk in microinsurance markets and inquire into the appropriateness of standard approaches and current practices. We draw upon the actuarial and economic literature to create a toolbox of approaches that has solved similar problems in other markets. To our knowledge, this paper is the first actuarial and economic discussion of consistent schemes for pricing risk in microinsurance markets. Our results are thus significant for insurers and reinsurers active in these markets as well as for those planning to enter. The results are also of interest to policymakers, regulators, and development organizations that work toward enhancing the development of microinsurance markets. Readers who are not familiar with insurance pricing techniques benefit from this survey to deal with problems specific in microinsurance markets. Readers who are familiar with this field may find interesting new applications of existing approaches in microinsurance. We thus highlight the lessons to be learned from the experiences of different insurance markets to offer solutions to some of the problems in microinsurance markets. In this regard, we explain the fundamental features and refer to the respective literature for a more detailed account.

The remainder of this article is structured as follows. Section 2 reviews the principles of actuarial pricing. In Section 3, we describe the challenges in pricing risk in microinsurance markets. A discussion of the set of opportunities to estimate technical premiums is presented in Section 4. In Section 5, we extend the discussion to the interaction of premiums, demand, and behavior in microinsurance markets. Section 6 concludes.

2. FUNDAMENTAL PRINCIPLES OF ACTUARIAL PRICING

Insurance is a mechanism to exchange contingent future payments against fixed payments, or premiums (see Wang, 1995). The actuarial rationale for the determination of technical premiums or prices for insurance risk is that these need to be sufficient to cover future losses on average. The equivalence principle is derived from this rationale as the origin for pricing insurance risk and defines the pure technical insurance premium such that the present value of expected premiums is equal to the present value of expected losses and expected cost for providing insurance coverage.

For the fundamental approach of pricing insurance risk, assume that X is the total random loss from an insured risk pool in a specified time period. The random variable X has mean μ and standard deviation σ. Since the corresponding premium is set ex ante, it is necessary to estimate the parameters μ and σ in advance (see Bühlmann, 1985). Thus, the expectation on losses μ is included in the calculation of the pure technical insurance premium π.

Since future losses are random and the premium π is set ex ante, the pure technical insurance premium may not be sufficient to cover all losses and cost in the future with a certain probability. However, insurers can control the probability of insolvency α by adding a relative or a fixed risk-loading that depends on the distribution of losses X. The required technical premium π for insurance risk that controls for risk of insolvency α is hence defined by $\pi = (1 + \theta)\mu$ for a relative risk-loading θ, and by $\pi = \mu + \tau$ for a fixed risk-loading τ.

The risk-loadings can be derived by a variety of principles, all of which are intended to limit the risk of insolvency to a sufficiently small value (see, e.g., Embrechts, 2000 for a discussion of premium principles). If a large enough number of insured n is assumed, the central limit theorem yields $\theta = (z_{1-\alpha}\sigma)/(\mu\sqrt{n})$ for the relative risk-loading and $\tau = (z_{1-\alpha}\sigma)/(\sqrt{n})$ for the fixed risk-loading where $z_{1-\alpha}$ denotes the $(1 - \alpha)$-quantile of the standard normal distribution (see Kliger & Levikson, 1998). In both cases, as the number of insured n increases, the average loss per insured approaches the real mean loss, i.e., the risk-loading becomes arbitrarily close to zero as n approaches infinity (see Cummins, 1991). In the case of independence of losses in the risk pool, both approaches are equivalent and allow the insurer to control the probability of insolvency α either by raising the risk-loading or by increasing the number of insured n.

A central implication of this result is that the risk-loading—and subsequently the premium—may *ceteris paribus* be decreased at a constant level of insolvency risk α when the number of insured n is increased. This is an important result since microinsurance institutions typically are relatively small—in many cases too small to achieve sufficient risk pooling to decrease risk-loadings.

Aside from the total future losses, the insurer has additional cost originating in the organization (e.g., distribution, management, and settlement) and from financing of the organization, specifically the cost of capital.[2] These cost need to be covered by premium income and are typically reflected in a cost-loading c. Often, in the insurance literature, the cost-loading is assumed to be proportional to the expected loss of an insurance policy (see, e.g., Raviv, 1979). Thus, the required technical premium π for insurance risk controlling for risk of insolvency and including cost is $\pi = (1 + \theta + c)\mu$ or $\pi = (1 + c)\mu + \tau$ respectively.

Pricing health, nonlife, and life insurance originates in the equivalence principle. However, different properties of the risks insured in the respective lines of business require divergent approaches to the application of the equivalence principle. This is mainly attributable to the different durations of risk coverage and properties of risk severities. Whereas health, nonlife, and some life insurance coverage is usually short-term and renewed or terminated at the end of the term (commonly one year), most life insurance policies are long-term contracts. In short-term insurance, risk frequency and severity are usually stochastic; in most life insurance only the time of risk occurrence cannot be known with certainty.

3. CHALLENGES IN MICROINSURANCE PRICING

There exist significant problems in the practice of pricing risk in microinsurance markets (see, e.g., Dlugolecki, 2008). The most fundamental of these problems is data availability, for four reasons. First, microinsurance markets have a short track record because the industry is relatively young. Thus, historical data on risk is limited. Second, many microinsurers are small, such that internal experience data generated from insurance pools is insufficient for statistical analysis and premium calculation. Third, internal and external reporting standards as well as the documentation of the loss history of insured are often poor in microinsurance markets, limiting the capacity to analyze risk.