To insure or not to insure? Analysis of foresters' willingness-to-pay for fire and storm insurance

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ABSTRACT

Natural catastrophes in forests have become more damaging in recent years and are expected to further increase according to climate change scenarios. Currently, governmental measures mostly focus on providing financial support, such as direct payments, to forest owners after disasters. However, in the light of more weather extremes, this could lead to a heavier financial burden for national budgets. Therefore, the current financial support system has to be reconsidered with regard to privatizing foresters' risks. Insurance could play a key role, but in many countries forests are rarely insured. In order to explain insurance coverage, we analyzed foresters' preferences regarding fire and storm insurance, which are expressed as their willingness-to-pay (WTP). Therefore, we measured the risk attitude and conducted a discrete choice experiment with 137 German foresters, using various policy and forest enterprise scenarios. Our results show that most foresters have a very low WTP for insurance, and individual risk attitude was not of significant influence. The WTP was higher for fire than for storm insurance, presumably due to liquidity preservation motives. Policy programs involving unconditional support after disaster reduced the WTP. Instead, subsidized insurance premiums increased the WTP and thus, should be considered to establish an efficient insurance market.

1. Introduction

The economic success of timber production on forestland is greatly influenced by natural risks, most severely by forest fires and storms (Zhang and Stenger, 2014). For instance, in Europe, 8% of the total felling is caused by damages. 53% of the damages is due to storms and 16% to fire (affecting 0.15% of forestland), while the magnitude of these damages increases over time (Schelhaas et al., 2003). In reaction, foresters, who are predominantly risk-averse (Brunette et al., 2014b; Musshoff and Maart-Noelck, 2014), consequently aim to reduce their risks. Depending on foresters' preferences for risk reduction and the characteristics of their stands, business risks can be diminished by reducing the probability of a calamity-caused damage, e.g., by silvicultural measures, and/or by reducing the magnitude of the potential financial loss, e.g., with insurance (Gardiner et al., 2013). While measures for risk reduction are suggested by many countries and are widely applied (Brunette et al., 2014a), there are still many situations in which they cannot

effectively reduce the risk of catastrophic losses or they are not cost effective. Thus, in this context, insurance could play a key role.

However, despite the need for improved insurance coverage (Chen et al., 2014), several studies provide evidence that there is a very low demand from foresters for standing timber insurance across many countries (Chen et al., 2014; Deng et al., 2015; Holecy and Hanewinkel, 2006; Zhang and Stenger, 2014). The main reason for this behavior is believed to be the absence of competitive insurance markets. Due to the low share of insured forest stands, insurers do not have sufficient empirical data on forest damages. This, in turn, impedes the taxation of forest value and leads to increased transaction costs and, thus, higher insurance premiums (Holecy and Hanewinkel, 2006; Zhang and Stenger, 2014). In this context, Holecy and Hanewinkel (2006), as well as Brunette et al. (2015) demonstrated that insurance premiums could be reduced substantially by increasing the insured area.

Instead of starting initializing policy insurance programs, many countries try to overcome the absence of efficient standing timber insurance markets by providing financial compensation in the case of catastrophic damages, which becomes a substitute for standing timber insurance (Brunette and Couture, 2008; Zhang and Stenger, 2014). However, forest disaster relief appears to be a growing burden

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for many countries (Chen et al., 2014; Holecy and Hanewinkel, 2006). As a solution, some countries, such as China (Qin et al., 2016) and the European Union ("An EU Strategy on adaptation to climate change"), are now promoting insurance.

To build up an efficient insurance market, it is essential to know foresters' insurance preferences, beliefs, and perceptions of forest risks, in addition to understanding the effects of public programs (Brunette et al., 2013). These effects are expressed in foresters' willingness to pay (WTP)[1] for standing timber insurance. Yet only a few studies have addressed this topic (Brunette et al., 2013, 2014a; Deng et al., 2015; Hartebrodt et al., 2007; Holthausen and Baur, 2004), leaving many issues still unresolved (Brunette et al., 2013). Hence, the questions arise, what is foresters' WTP for forest insurance and which parameters have an influence on the WTP. This information is crucial in order to fully understand foresters' insurance decision-making behavior and to derive effective policy measures.

In this study, we contribute to answering these questions by means of a framed-field experiment (Harrison and List, 2004). Economic experiments cannot entirely replicate the real decision situation; they can, however, replicate certain aspects of interest from the real insurance decision situation, while varying the underlying conditions (Davis and Holt, 1993, pp. 14–18) . This would not be possible with empirical data in the same way, even if they were available. More specifically, we use a discrete choice experiment (DCE) for measuring foresters' WTP for storm and fire insurance under different forest and policy scenarios. This approach enables us to control for foresters' risk attitude, as well as their socio-demographic and forest enterprise-related characteristics. The DCE approach has several advantages over previous WTP analysis, in which the WTP was elicited by asking for it directly (e.g., Brunette et al., 2014a; Deng et al., 2015; Hartebrodt et al., 2007; Holthausen and Baur, 2004). Firstly, the insurance decision situation is closer to reality. In the DCE, participants are confronted with several insurance alternatives that they can choose from. This situation can be seen as a replication of the real decision situation, where foresters are confronted with several insurance offers. Secondly, the design of the decision situation is cognitively less demanding than open questions, which reduces the risk of "wild guesses" (Hanley et al., 2003). Thirdly, by analyzing revealed preferences, the DCE approach bears lower risk of strategical answers. As a result, the expressed WTP is more accurate (Hanley et al., 2003).

The study is conducted in Germany, since damages differ by regions and diverse policy measures are implemented. Forest fires occur most frequently in northern Germany, where forests are dominated by Scots pine. More severely, the southern and western parts of Germany were affected by storms such as *Vivien/Wiebke* (1990), *Lothar* (1999) and *Kyrill* (2007). To put it in perspective, *Lothar* alone led to 30 million m³ of thrown timber (Holecy and Hanewinkel, 2006). Policy measures in Germany exist on the national level (e.g., tax relief) and on the federal state level (e.g., payments for reforestation or premium subsidization). Although, standing timber insurance is available nationwide for fire and storm risks, only a small percentage of forest nationwide is insured, especially for storm risks (Brunette and Couture, 2008; Holecy and Hanewinkel, 2006).

For the conception and interpretation of the experiment, we draw on studies that analyze various aspects of the aforementioned questions by means of a theoretical model (e.g., Brunette and Couture, 2013; Brunette et al., 2015), by surveys (e.g., Deng et al., 2015; Hartebrodt et al., 2007; Holthausen and Baur, 2004) as well as by an international comparison of standing timber insurance schemes (Zhang and Stenger, 2014). The approach closest to ours is that of Brunette et al. (2013, 2014a), who investigated the WTP under different policy scenarios for forest owners in France. While Brunette et al. (2013, 2014a) asked foresters directly for their WTP, we measure the WTP indirectly by providing hypothetical insurance offers in the framework of the DCE. Additionally, we analyzed the influence of participants' experimentally measured risk attitude on the insurance decision. Furthermore, scenarios in this experiment cover not only fire risk in pine stands, but also other tree species with different vulnerabilities to fire and storm risks.

Thus, the scientific contribution of this article is threefold. First, in response to the statement by Brunette et al. "[F]urther investigations of the impact of various government insurance programmes on insurance behaviours are required" (Brunette et al., 2013, p. 167), we provide a comprehensive examination of the WTP for standing timber insurance. WTP is analyzed with regard to different policy scenarios, various tree species, and further forest-enterprise-related and socio-demographic factors. Second, to the best of our knowledge, we are the first to apply the DCE approach for analyzing foresters WTP for forest fire and storm insurance simultaneously. We thereby contribute to the experimental approach in the context of forest risk management. Third, we are one of the first studies in forest economics measuring the risk attitude of foresters experimentally and analyzing its influence on the insurance decision. Accordingly, we use the Holt and Laury task (Holt and Laury, 2002), which has been established as a standard method to measure the risk attitude with regard to economic decision-making.

This article is structured as follows: Hypotheses are derived in Section 2. Section 3 provides the experimental design as well as the methodology for analysis. In Section 4, the resulting experimental data is examined and discussed with regard to the derived hypotheses. Finally, the article is concluded in Section 5 with an overview of the main results and policy implications, as well as recommendations for further research on this topic.

2. Hypotheses derivation

In order to answer our research question, the hypotheses focus on eliciting the WTP for standing timber insurance and identifying the influencing factors, such as policy programs. For the remainder of this article, WTP refers to the loading factor of the insurance, where loading is expressed as a relative figure to the fair premium. Therefore, the fair premium is defined as the annualized expected payout from the insurer due to forest damages. The loading covers, for instance, insurer's administrative costs, risk premiums and profit margin.

2.1. Foresters' preferences in insurance decisions

According to expected utility theory, risk-averse decision makers are willing to relinquish part of their risky income if they can reduce the income risk efficiently (e.g., Camerer and Kunreuther, 1989). Foresters' risk attitudes were experimentally examined, for instance, in the studies of Brunette et al. (2014b) and Musshoff and Maart-Noelck (2014), who revealed that foresters are predominantly risk-averse. Theoretically, this implies that most foresters' insurance WTP should be positive or even highly positive (cf. Mossin, 1968). However, empirical findings reveal that foresters rarely insure their forests. For instance, through the use of a questionnaire, Deng et al. (2015) demonstrated that foresters have a high interest in standing timber insurance, but their elicited mean WTP for insurance

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[1] Willingness to pay express the maximum amount of money, participants would pay for a good or a service (Davis and Holt, 1993, p. 458). The WTP is frequently analyzed in experiments, since its measurement emerged as powerful tool to capture participants' preferences in a condensed way. Especially in the absence of efficient markets, the WTP analysis is beneficial in order to determine consumers' reservation price (Davis and Holt, 1993, p. 457).