



# The risk implications of insurance securitization: The case of catastrophe bonds

Bjoern Hagendorff<sup>a</sup>, Jens Hagendorff<sup>b,\*</sup>, Kevin Keasey<sup>a</sup>, Angelica Gonzalez<sup>b</sup>

<sup>a</sup> University of Leeds, Maurice Keyworth Building, Leeds LS2 9JT, UK

<sup>b</sup> University of Edinburgh, 29 Buccleuch Place, Edinburgh EH8 9AL, UK

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## ABSTRACT

Catastrophe (Cat) bonds are insurance securitization vehicles which are supposed to transfer catastrophe-related underwriting risk from issuers to capital markets. This paper addresses key, unanswered questions concerning Cat bonds and offers the following results. First, our findings show firms that issue Cat bonds exhibit less risky underwriting portfolios with less exposure to catastrophe risks and overall less need to hedge catastrophe risk. These results show that the access to the market for insurance securitization is easiest for firms with less risky portfolios. Second, firms that issue Cat bonds are found to experience a reduction in their default risk relative to non-issuing firms and our results, therefore, demonstrate that Cat bonds provide effective catastrophe hedging for issuing firms. Third, firms with less catastrophe exposure, increase their catastrophe exposure following an issue. Therefore, our paper cautions that the ability to hedge catastrophe risk causes some firms to seek additional catastrophe risk.

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## 1. Introduction

Why firms choose to hedge, the effects of hedging on firm risk profiles and its implications for firm policy are important questions that a considerable literature in corporate finance has addressed over decades. In this paper, we add to this literature by analyzing the above questions for the case of catastrophe (Cat) bonds. Cat bonds are financial claims that protect the issuing firm from catastrophe losses by letting it forfeit on principal and/or coupon payments if a specified catastrophe loss event occurs (Cummins et al., 2002; Froot, 2001; Froot and O'Connell, 2008). Because Cat bonds relieve their issuers of some debt payments in the event of a natural catastrophe, their issue can be seen as a form of hedging against natural catastrophe risks. However, despite the fanfare with which Cat bonds were launched in the 1990s, Cat bonds have trailed expectations as the total volume of Cat bonds outstanding has remained relatively modest to date. This raises important questions over if and how Cat bonds work as a hedge against catastrophe risks and, more broadly, what determines whether firms engage in insurance securitization.

The background to our paper is that firms with exposure to catastrophe risks have seen sharp increases in underwriting losses over recent decades. Crucially, the ability of insurers to finance these mounting catastrophe losses is uncertain mainly because the catastrophe underwriting capacity of the reinsurance markets, the conventional channel through which firms hedge their catastrophe exposures, is limited. Events such as the recent tsunami in Japan or Hurricane Katrina in 2005 have, therefore, default risk implications for individual insurers and can, potentially, cause distress in the global insurance markets if they bring about the default of an insurer or a series of insurers.

Partly in response to concerns over the default risk implications of natural catastrophes for insurers, insurance securitization vehicles such as Cat bonds, mortality bonds and sidecars have emerged which are supposed to transfer catastrophe risks from

\* Corresponding author. Tel.: +44 131 6502796.

E-mail addresses: [bn08bh@leeds.ac.uk](mailto:bn08bh@leeds.ac.uk) (B. Hagendorff), [jens.hagendorff@ed.ac.uk](mailto:jens.hagendorff@ed.ac.uk) (J. Hagendorff), [kk@lubs.leeds.ac.uk](mailto:kk@lubs.leeds.ac.uk) (K. Keasey), [Angelica.Gonzalez@ed.ac.uk](mailto:Angelica.Gonzalez@ed.ac.uk) (A. Gonzalez).

insurers to capital markets. Among these insurance securitization vehicles, Cat bonds have been by far the most commonly used insurance securitization vehicle with nearly \$31 billion of risk capital (i.e. the total of bond principal and coupon payments at risk) issued between 1997 and 2010 (AON Capital Markets, 2010).<sup>1</sup> The total outstanding risk capital of Cat bonds issued between 1997 and 2010 corresponds to about 8% of insured catastrophe losses during that period.<sup>2</sup> While this makes Cat bonds a considerable risk transfer mechanism for hedging catastrophe risk, the total coverage via Cat bonds has remained behind earlier expectations that saw Cat bonds as a substitute to catastrophe reinsurance.

The low volumes of Cat bonds could partly be due to uncertainty over whether Cat bonds actually cause a significant transfer of catastrophe-related risk away from underwriters (Finken and Laux, 2009; Froot, 2001). There have long been concerns that a risk transfer may not occur or be of only negligible magnitude. This is because, even though Cat bonds exhibit some hedging properties, they rarely meet the conditions that make them a perfect hedge against catastrophe underwriting losses. For instance, there are suggestions that issuers only securitize remote catastrophe risks.<sup>3</sup> Consistent with this, few Cat bonds have caused losses for investors to date. This point is illustrated by Fig. 1 which shows that the total returns for investors in Cat bonds (measured by the Swiss Re Global Cat Bond Total Return Index) have increased steadily despite highly volatile and generally increasing catastrophe losses realized by the insurance industry. Further, there is little association between Cat bond returns for investors and insured catastrophe losses. This is puzzling, because if Cat bonds were to offer a meaningful hedge against catastrophe-related underwriting risk, Cat bond returns and the catastrophe losses borne by the industry should be negatively related.

A further factor which casts doubt on the ability of Cat bonds to reduce the default risk of their issuers is that the triggers which permit the issuers of Cat bonds to forfeit often do not match the specific loss experience of the issuer. Few Cat bonds use so-called indemnity triggers where payoffs are defined in terms of the issuer's realized losses. Instead, triggers are often defined in terms of industry-wide losses (e.g. via loss indices). These non-indemnity triggers give rise to basis risk which may leave insurers which have issued Cat bonds facing default in the event of high individual losses but low index losses (see Cummins et al., 2004; Harrington and Niehaus, 1999).<sup>4</sup>

The above concerns prompt us to ask three important questions around Cat bonds and insurer default risk. First, which type of firms issue Cat bonds in a given year? It is important to understand the default risk implications of Cat bonds in the context of why firms issue Cat bonds. For instance, if insurance securitization was conducted by firms with very risky portfolios or follows large loss events for the industry or individual firms, any reduction in default risk post-issue may be unrelated to a Cat bond reducing default risk and may instead be due to default risk simply reverting to its long-term equilibrium after a loss event.

Second, are Cat bonds effective in reducing insurer default risk and, if yes, do they indeed provide a hedge against catastrophe risk? It is important to bear in mind that Cat bonds could bring about a reduction in default risk not as a result of hedging catastrophe underwriting risks, but because of other risk-reducing attributes. For instance, unlike reinsurance, Cat bonds involve no counterparty risk. The pay-offs from Cat bonds for insurers are independent of the counterparty remaining solvent and Cat bond principals are fully collateralized (Lakdawalla and Zanjani, 2012).<sup>5</sup> Third, does hedging via insurance securitization affects underwriting behavior in the period following the issue of a Cat bond? If firms were to engage in a riskier underwriting strategy after they issued a Cat bond, this would raise the possibility of instability in global insurance and reinsurance markets if Cat bonds, though risk-reducing, cause some insurers to load up on more of the type of risks they have hedged via Cat bonds. In addressing these questions, this paper makes the following contributions.

We provide the first empirical examination into the determinants of firms issuing Cat bonds. Existing theory on this subject has come to conflicting predictions as regards, for instance, whether issuers have portfolios with a high potential for underwriting losses (Subramanian and Wang, 2013) or less risky portfolios (Gibson et al., 2011). Our results show that firms which issue Cat bonds have less catastrophe risk exposure and lower risk portfolios overall and, therefore, back explanations that access to the market for insurance securitization is easiest for firms with less risky portfolios. Put differently, our results show that Cat bond issuers typically are not firms with high-risk or high-exposure portfolios in need to offload catastrophe risk to the financial markets.

Second, we present the first empirical investigation into the realized risk implications of insurance securitization. Previous work on the risk implications of Cat bonds is based on simulations (Cummins et al., 2004; Harrington and Niehaus, 2003) and pointed out the various other risk-based effects of Cat bonds which are not necessarily linked to hedging catastrophe risk (Cummins and Weiss, 2009;

<sup>1</sup> The volume of Cat bonds has grown rapidly following the particularly disastrous U.S. hurricane season of 2005 ('Catastrophe-Bond Supply Builds Up', *The Wall Street Journal*, 27 September 2006). Increasingly, Cat bonds are also attracting the attention of retail investors ('Catastrophe Bonds: Ports and Storms', *The Economist*, 2 August 2007) as well as governments in developing countries seeking affordable ways of financing reconstruction in the aftermath of natural catastrophes ('Catastrophe Insurance: When Calamity Strikes', *The Economist*, 21 January 2010).

<sup>2</sup> Based on the authors' calculations using Swiss Re Sigma Reports dating from 1997 to 2010. See also, 'Catastrophe bond offerings decline despite strong returns', *Financial Times*, 29 August 2008.

<sup>3</sup> Catastrophe bonds prove anything but a disaster, *Financial Times*, 2 June 2013.

<sup>4</sup> Both Harrington and Niehaus (1999) and Cummins et al. (2004) use simulation analyses to show that the basis risk linked to index-based triggers is manageable for U.S. homeowner insurers and large Hurricane insurers in Florida, respectively. However, it is important to bear in mind that these results are based on simulations. The risk that the payoffs from index-based Cat bonds do not cover the issuer's catastrophe losses remains a concern for issuing firms.

<sup>5</sup> Further, Cat bonds shield issuers from volatile reinsurance premiums in the reinsurance markets where markets typically 'harden' and premiums increase rapidly following industry loss events (Cummins and Weiss, 2009; Froot and O'Connell, 2008). Cat bonds have a maturity of typically two to three years. This makes the cost of risk management via Cat bonds more predictable compared with reinsurance contracts which have a typical risk period of only one year. Consequently, the costs of coverage via Cat bonds are fixed for the issuer until the bond's maturity and remain fixed irrespective of underwriting losses realized by either the issuer or the industry. Since large loss events typically cause reinsurance markets to 'harden', leading to higher prices, the multi-year maturity of Cat bonds may shield insurers from unexpected hikes in the pricing of catastrophe risk management (or a loss of coverage if reinsurance pricing becomes too unattractive).

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