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Reinsurance or securitization: The case of natural catastrophe risk

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ABSTRACT

We investigate the suitability of securitization as an alternative to reinsurance for the purpose of transferring natural catastrophe risk. We characterize the conditions under which one or the other form of risk transfer dominates using a setting in which reinsurers and traders in financial markets produce costly information about catastrophes. Such information is useful to insurers: along with the information produced by insurers themselves, it reduces insurers' costly capital requirements. However, traders who seek to benefit from trading in financial markets may produce 'too much' information, thereby making risk transfer through securitization prohibitively costly.

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1. Introduction

Traditional catastrophe reinsurance has in recent years come under scrutiny in the academic literature. In his study of the market for catastrophe risk, Froot (2001) shows that insurers should optimally reinsure against large catastrophic events first. Moreover, since catastrophe risks are uncorrelated with aggregate financial wealth, reinsurance premia should reflect expected losses. Both of these conjectures are invalidated by Froot's study of the aggregate profile of reinsurance purchases: insurers tend to reinsure medium-size losses, but retain (rather than reinsure) their large-event risks; the reinsurance premia they pay often are a multiple of expected losses. Froot explains these phenomena mainly by the inefficiencies that characterize the supply of capital to reinsurance companies and by these companies' excessive market power. Doherty (1997) argues that these inefficiencies of the reinsurance market should spur the development of alternative forms of risk transfer, such as securities traded on financial markets. Because financial markets can draw on a larger, more liquid and more diversified pool of capital than the equity of reinsurance companies, they should have a strong advantage over reinsurance in financing catastrophe risk (Durbin, 2001). Cummins and Weiss (2009) document the growing use of securitization in financial markets to transfer catastrophe risk. They provide evidence of market take-off, especially as regards catastrophe bonds. As noted by Cummins and Weiss, the success of over-the-counter (OTC) traded catastrophe bonds has not extended to exchange-traded catastrophe instruments: there has been little to no interest in the catastrophe futures and option contracts introduced by exchanges as diverse as the Chicago Board of Trade (CBOT), the Bermuda Commodities Exchange (BCOE), the New York Mercantile Exchange (NYMEX), the Chicago Mercantile Exchange (CME), and the Insurance Futures Exchange (IFEX); at the time of writing, only the contracts introduced in 2007 by the CME appear still to be trading, at low volumes.

In this study, we compare reinsurance and securitization in financial markets for the purpose of transferring natural catastrophe risk and characterize the conditions under which one or the other form of risk transfer dominates. We consider the case of an insurer exposed to natural catastrophe risk. The insurer seeks to supplement the costly information it has produced about possible losses with information obtained from a reinsurer or from prices in financial markets. Such information is valuable to the insurer, for it decreases that insurer's costly capital requirements: the better the insurer understands the risk to which it is exposed, the lesser the amount of capital the insurer needs to guard against such risk. The insurer also seeks to take advantage of the reinsurer and the financial markets' lower cost of capital. Reinsurers are considered to have lower cost of capital than insurers because they are larger

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and more diversified. The financial markets' cost of capital is low for two reasons: (i) margin requirements in financial markets differ from equity investments in reinsurance companies in not involving the agency problems that raise the cost of external capital[3]; (ii) natural catastrophe risk has had low correlation with aggregate wealth (Cummins and Weiss, 2009).

We ask which form of risk transfer, reinsurance or securitization in financial markets, minimizes the total cost of bearing catastrophe risk to the insurer. Total cost includes the cost of the capital that must be held by the insurer, that of the capital that must be held by the reinsurer to which a fraction of the risk has been transferred, and the cost of producing the information that helps both insurer and reinsurer decrease capital requirements and provides informed traders in financial markets with the opportunity to profit at the expense of liquidity traders. We find that informed traders who seek to benefit from trading in financial markets may in some cases produce more information than warranted by the primary objective of decreasing insurer capital requirements; there is 'too much' information. This is costly to insurers, who bear the cost of information production through the discount they must offer liquidity traders to compensate these traders for the losses they expect to sustain informed traders.

We use a rich setting to investigate the key factors that affect the relative cost of risk transfer through reinsurance and securitization. In our setting, there are fixed and variable costs to producing information; the larger the variable costs incurred, the higher the quality of the information. There is also some substitution between fixed and variable costs, in the sense that the aggregation of many pieces of lower quality information can result in a higher quality piece of aggregated information. Such aggregation characterizes financial markets (Grossman, 1989); the increase in information quality it makes possible is greater, the more complementary – the less redundant – the many pieces of information produced by informed traders.

We find that the production of too much information at too high a cost in financial markets is more likely (i) where the fixed costs of producing information are high, (ii) where the variable costs of producing information are low, (iii) where there are many liquidity traders, and (iv) where losses about which information is produced are highly uncertain. To understand the intuition for these results, recall that reinsurance and securitization in financial markets represent two alternative mechanisms for providing the insurer with information. Financial markets are at a disadvantage where it is preferable to have one party – the reinsurer – produce a single piece of high quality information to supplement that produced by the insurer than to have many parties – informed traders in financial markets – produce numerous pieces of generally lower quality information. Where variable costs are low relative to fixed costs, the indirect production of high quality information through aggregation in financial markets is less efficient than the direct production of that information by a single reinsurer that incurs both the fixed and the variable costs of producing high quality information; reinsurance dominates securitization. Such dominance is generally compounded by the presence of many liquidity traders and by large uncertainty about losses: the greater the presence of liquidity traders and loss uncertainty, the greater informed traders' profit opportunities, the greater these traders' incentive to produce information for the purpose of taking advantage of these opportunities; this exacerbates the problem of excess information production in financial markets. Result (iv) is consistent with the finding that insurers with less risky portfolios are more likely to issue catastrophe bonds (Hagendorff et al., 2014), to which the stock market responds more positively (Hagendorff et al., 2013). Result (iii) is consistent with the aforementioned success of catastrophe bonds and relative failure of exchange-traded catastrophe futures and options: there are few, if any liquidity traders in OTC markets, unlike in exchanges.[4]

Redundancy in the information produced – how similar are the pieces of information produced by informed traders in the financial markets – favors reinsurance where there is large loss uncertainty and securitization in financial markets where there is little. Where large loss uncertainty elicits the need for information to supplement that produced by the insurer, there is much inefficiency producing numerous pieces of redundant information; redundancy favors reinsurance over securitization. Where, in contrast, there is little loss uncertainty and little need for supplemental information, redundancy decreases informed traders' profit opportunities, thereby deterring these traders' entry. There is little information production in financial markets, which come to dominate reinsurance by virtue of their lower cost of capital.

The paper proceeds as follows. Section 2 reviews the literature. Section 3 presents and solves our model of an insurer that seeks to transfer a fraction of the risks he has insured either through reinsurance or through securitization. Section 4 considers the two polar cases of no and full redundancy for the purpose of providing some preliminary intuition and illustrating some of the tradeoffs involved. Section 5 identifies the determinants of the preferred forms of risk transfer. Section 6 concludes.

2. Literature review

Our paper is in the line of a number of papers that have compared private and public financing; in our case, reinsurance is private financing and securitization public. Examples of such papers are Bolton and Freixas (2000), Boot and Thakor (1997), Chemmanur and Fulghieri (1994), and Subrahmanyam and Titman (1999). In many of these papers, the basic problems are those of moral hazard and adverse selection. We acknowledge the importance of moral hazard and adverse selection in natural catastrophe risk transfer; indeed, we rely on such considerations to preclude the complete transfer of risk from insurer to reinsurer or financial markets (see Section 3). We follow Carter (1983) and Mayers and Smith (1990) in deeming information provision to be no less important.[5] Boot and Thakor examine information provision in public markets but not in private. Subrahmanyam and Titman compare private and public financing for the purpose of information provision; we adapt and modify their model for our purpose. Our model differs from theirs in many respects: it includes variable as well as fixed costs of producing information and develops an explicit measure of information redundancy.

There is an extensive literature on the use of securitization in financial markets for transferring catastrophe risk (D'Arcy and France, 1992; Niehaus and Mann, 1992). Such literature has examined the advantages of financial markets, emphasizing their risk disaggregation (Doherty and Schlesinger, 2002) and capital supply (Jaffee and Russell, 1997) properties, and their lack of exposure to moral hazard and to default risk (Doherty, 1997; Lakdawalla

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[3] See Froot et al. (1993), Froot and Stein (1998), and Froot (2007) for a discussion of such costs. We discuss this issue in further detail in Section 3.3.2.

[4] Most catastrophe bonds have been sold under Rule 144A to Qualified Institutional Buyers (QIBs); few QIBs can be considered liquidity traders, in the sense of consistently sustaining trading losses to informed traders.

[5] Anecdotes are worth what they are worth, but it is noteworthy that, in his closing remarks at a joint industry/academia conference on new forms of risk transfers, the chairman of a large reinsurance company felt it necessary gently to chide presenters for not having discussed what he deemed a primary role of his firm and of reinsurers more generally, specifically helping insurers structure the insurance contracts they offer. We provide more formal evidence of information provision in Section 3.1.

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