INSURING THE 'UNINSURABLE': CATASTROPHE BONDS, PANDEMICS, AND RISK SECURITIZATION

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ABSTRACT

In principle, governments could protect against the potential economic devastation of future pandemics by requiring businesses to insure against pandemic-related risks. In practice, though, insurers do not currently offer pandemic insurance. Although they may well be able to obtain sufficient actuarial data to set pandemic underwriting standards and rate tables, insurers are concerned that they lack sufficient capacity, as an industry, to cover those risks, which are likely to occur worldwide and to be highly correlated. Pandemics therefore are in the class of risks, like war, terrorism, and riots, that are deemed "uninsurable," at least by private markets. This Article examines how risk securitization—a relatively recent and innovative private-sector alternative to government insurance, funded by the issuance of catastrophe (CAT) bonds—could be used to help insure pandemic-related risks. Risk securitization would utilize the "deep pockets" of the global capital markets, which have a far greater capacity than the global insurance markets, to absorb these risks. The Article also identifies and analyzes the novel legal and economic challenges that risk securitization would raise. Certain of these challenges parallel but are more complex than those arising in structuring traditional securitization transactions. Other challenges involve issues of first impression, including the extent to which risk securitization should be regulated as a form of reinsurance, the constitutionality of requiring that businesses purchase pandemic insurance, and the legality and relative prioritization of public-private risk sharing—such as Chubb's recent government-risk-sharing proposal.

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INTRODUCTION

Insurance is the tried-and-true strategy for protecting against infrequent but potentially devastating losses.[1] Insurers are expert third parties that

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1. *See, e.g.*, JOHN H. BIGGS & MATTHEW RICHARDSON, *Modernizing Insurance Regulation: An Overview, in* MODERNIZING INSURANCE REGULATION 1, 1 (2014) ("Insurance allows individuals and businesses to protect themselves against potentially catastrophic financial risks."); *Disaster Risk*

expand policyholders' loss-absorption capacity and assist them, at least indirectly, to monitor risks.[2] In theory, therefore, governments could protect against the potential economic devastation of future pandemics by requiring businesses to insure against pandemic-related risks.[3] As later discussed, that requirement would be needed because, in its absence, even businesses that otherwise view pandemic insurance as economically desirable would tend to forgo paying for such insurance, expecting a government bailout in the event of a major pandemic.[4]

Insurers currently cover certain of those risks. Standard health insurance policies cover much of the medical costs incurred by employees (and others) who contract diseases,[5] and most life insurance policies cover pandemic-caused deaths.[6] Many pandemic-related risks remain uninsured, though. For example, business-interruption insurance either explicitly excludes pandemic-related disruptions or has been interpreted to condition payments on physical damage causing the disruption.[7] Nor does insurance currently cover all of the increased unemployment[8] or pandemic-related infrastructure

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Insurance, UN DEVELOPMENT PROGRAMME (Dec. 18, 2017), https://www.undp.org/content/dam/sdfinance/doc/Disaster%20Risk%20Insurance%20_%20UNDP.pdf (discussing the importance of insurance to protect against possible disasters).

2. Howell E. Jackson & Steven L. Schwarcz, *Protecting Financial Stability: Lessons from the Coronavirus Pandemic*, 11 HARV. BUS. L. REV. (forthcoming 2021), https://ssrn.com/abstract=3644417 (observing that other such third-party loss-absorption and risk-monitoring arrangements include the skin-in-the-game rules for securitization transactions, the requirement of centralized clearing for many derivatives transactions, and the imposition of bail-in-able debt instruments to increase firms' total loss absorbing capital).

3. *See id.* (observing this mode of government protection).

4. *See infra* notes 381–388 and accompanying text.

5. *See* NAIC INSURANCE BRIEF: COVID-19 AND INSURANCE, NAT'L ASS'N OF INS. COMM'RS 2 (2020), https://content.naic.org/sites/default/files/inline-files/Insurance%20Brief%20-%20Covid-19%20and%20Insurance.pdf [https://perma.cc/S9QJ-3RS9].

6. *Id.* at 3.

7. *See* Russ Banham, *Demand Soars for Parametric Insurance to Cover Pandemic Business Interruptions*, CARRIER MGMT. (Apr. 2, 2020), https://www.carriermanagement.com/features/2020/04/02/205106.htm [https://perma.cc/B5U5-WJ48]; *Cf.* Leslie Scism, *Companies Hit by Covid-19 Want Insurance Payouts. Insurers Say No*, WALL ST. J. (June 30, 2020, 10:24 AM), https://www.wsj.com/articles/companies-hit-by-covid-19-want-insurance-payouts-insurers-say-no-11593527047 [https://perma.cc/6FGL-JMFA] (reporting that "[m]ore than half of [business interruption] policies in force today specifically exclude viruses," and even absent that exclusion, "insurance companies have largely refused to pay claims under this coverage, citing a standard requirement for physical damage").

8. Independent contractors, part-time workers, and self-employed individuals who lose their jobs are ordinarily not eligible for unemployment benefits. *See* Jeremy Pilaar, *Reforming Unemployment Insurance in the Age of Non-Standard Work*, 13 HARV. L. & POL'Y REV. 327, 338, 350 (2018). The CARES Act temporarily expanded access to unemployment benefits for these non-standard employment categories. *See* Pamela Foohey, Dalié Jiménez & Christopher K. Odinet, *Cares Act Gimmicks: How Not to Give People Money During a Pandemic and What to Do Instead*, 2020 U. ILL. L. REV. ONLINE 81, 86.

costs (such as installing Plexiglas barriers or reconfiguring interiors for safety).[9]

In practice, however, insurers do not currently offer pandemic insurance, certainly not at rates (i.e., "premiums") that businesses regard as reasonable.[10] Insurers fear their industry does not "have the capacity to [provide] coverage."[11] Because a pandemic by definition is worldwide, the obligation of insurers to make payments under pandemic insurance would likely be highly correlated, creating losses that would overwhelm the insurance markets.[12] Insurer unwillingness to offer pandemic insurance also may be due, in part, to the lack of sufficient statistical data to reliably set underwriting standards and rate tables reflecting the appropriate level of pandemic-related risks[13]—although some firms, such as Metabiota, Air Worldwide, Milliman, and RMS, claim to "combine leading

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9. *Cf.* Inti Pacheco, *How Much Covid-19 Cost Those Business That Stayed Open*, WALL ST. J. (June 23, 2020, 7:09 AM), https://www.wsj.com/articles/how-much-covid-19-cost-those-businesses-that-stayed-open-11592910575 [https://perma.cc/3FFJ-ARPK] (explaining that some businesses spent as much as one billion dollars in "increased pay for front-line workers, expanded cleaning and sanitization protocols, and . . . personal protective equipment").

10. In 2018, for example, the insurance broker and risk manager Marsh, in conjunction with Munich Re and technology firm Metabiota, offered "Pathogen Rx," an insurance policy covering pandemic-related business disruptions caused by stay-at-home orders. No policies were sold, however, possibly because businesses found the premiums unreasonably high. Banham, *supra* note 7. Possibly, too, "optimism bias" led businesses, having never experienced significant losses due to a pandemic, to discount the risk. Steven L. Schwarcz*, Regulating Complacency: Human Limitations and Legal Efficacy,* 93 NOTRE DAME L. REV. 1073, 1080 (2018) ("Optimism bias is the tendency to be unrealistically optimistic when thinking about negative events with which one has no recent experience, and devaluing the likelihood and potential consequences of those events.").

11. Evan Weinberger, *Chubb Pandemic Coverage Plan Exposes Industry Split*, BLOOMBERG L. (July 14, 2020, 4:31 AM), https://news.bloomberglaw.com/insurance/chubb-pandemic-coverage-plan-exposes-industry-split [https://perma.cc/8PZM-DX46]. *Cf.* Jackson & Schwarcz, *supra* note 2 (arguing the same); CHUBB, *infra* note 274 and accompanying text (stating that "[pandemic loss is] not insurable in the private [sector]").

12. *See* Weinberger, *supra* note 11 ("The insurance industry says paying out virus-related claims would cost trillions and would push many companies into insolvency."); *Understanding Business Industry Insurance and Pandemics*, INS. INFO. INST., https://www.iii.org/sites/default/files/docs/pdf/business_interruption_101_041320_2.pdf [https://perma.cc/NSR2-B8AZ] (arguing that pandemic insurance payouts would "bankrupt insurers").

13. Jackson & Schwarcz, *supra* note 2. To understand this lack of sufficient statistical data, compare car accidents and hurricanes. Car accidents generate sufficient statistical data because they occur all the time. Insurers can use these data to reliably calculate how many accidents are likely to occur in a given city and in a given year, and thus can price premiums accordingly. Infrequent and catastrophic events like hurricanes are more difficult for insurers. A significant hurricane may hit a particular city, for example, only once a decade. To help solve this problem, primary insurers can turn to reinsurers—insurance companies that insure other insurance companies—to statistically diversify the risk. Although a significant hurricane may hit a particular city only once a decade, a significant hurricane almost always hits *somewhere* in the world every year. By covering much larger geographical regions, reinsurers are able to treat hurricanes like primary insurers treat car accidents. The difficulty presented by global pandemics like COVID-19 is that, unlike hurricanes and car accidents, global pandemics affect the world's entire population. In this sense, reinsuring pandemic risk for large geographic regions is more like a primary insurer providing coverage for a particular city's hurricane damage than like reinsurers offering global coverage for hurricanes.

epidemiological, statistical and actuarial techniques to quantify [global] epidemic risk."[14]

Pandemics therefore are in the class of risks that are deemed "uninsurable," at least by private markets.[15] This category includes war, terrorism, riots, economic downturns, and various other extraordinary catastrophes such as meteor strikes and sudden shifts in the gulf stream caused by climate change.[16] Absent insurance, the other responses to address these catastrophes tend to be second-best.[17] Therefore, in areas of strong public interest such as nuclear reactor accident risk, governments sometimes provide publicly subsidized insurance—i.e., government insurance of otherwise "uninsurable" risks, paid for only partly by private sector entities that benefit from that insurance.

For example, the Price-Anderson Nuclear Liability Act of 1957 was enacted to ensure nuclear operators were adequately insured.[18] The act required nuclear operators to have the maximum insurance available (then $60 million). If damages exceeded that level, a second level of government-provided funds was available (up to $500 million).[19]

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14. *Metabiota Products*, METABIOTA, https://metabiota.com/product [https://perma.cc/BU5N-X79C]. *See also Air Worldwide Pandemic Model Brochure*, AIR WORLDWIDE, https://www.air-worldwide.com/siteassets/Publications/Brochures/documents/AIR-Pandemic-Model [https://perma.cc/S2M7-WDVU]; Robert Muir-Wood, *The Coronavirus Outbreak: Part One–Modeling "Spotting,"* RISK MGMT. & CATASTROPHE MODELING BLOG (Feb. 4, 2020), https://www.rms.com/blog/2020/02/04/the-coronavirus-outbreak-part-one-modeling-spotting [https://perma.cc/3XY4-TCQC].

15. *See, e.g.*, Dwight M. Jaffee & Thomas Russell, *Catastrophe Insurance, Capital Markets, and Uninsurable Risks*, 64 J. RISK & INS. 205, 205–06 (1997) (explaining that private insurers are reluctant to insure "low-probability high-consequence" catastrophic events, known by insurance textbook writers as "uninsurable risk"); Daniel Schwarcz & Steven L. Schwarcz, *Regulating Systemic Risk in Insurance*, 81 U. CHI. L. REV. 1569, 1611–12 (2014) (describing the risk of global pandemics as a catastrophic risk); Weinberger, *supra* note 11 (quoting Sean Kevelighan, the chief executive of the Insurance Information Institute, that "global pandemics are largely uninsurable").

16. Jackson & Schwarcz, *supra* note 2. *See also* Anne Freedman, *Top Five Uninsurable Risks*, RISK & INS. MAG. (Sept. 2, 2014), https://riskandinsurance.com/top-five-uninsurable-risks/ [https://perma.cc/9CRB-RQY6].

17. *Cf.* Amara Omeokwe & Yuka Hayashi, *SBA Under Fire for Failing to Get Aid to Struggling Small Businesses*, WALL ST. J. (Apr. 8, 2020, 7:00 AM), https://www.wsj.com/articles/sba-under-fire-for-failing-to-get-aid-to-struggling-small-businesses-11586343600 [https://perma.cc/CK5B-PMZC] ("A federal program to help small companies weather the coronavirus fallout has failed to distribute funds quickly . . . ."); Russell S. Sobel & Peter T. Leeson, *Government's Response To Hurricane Katrina: A Public Choice Analysis*, 127 PUB. CHOICE 55, 62 (2006) (discussing the failure of FEMA to efficiently and expeditiously allocate financial resources in the wake of Hurricane Katrina).

18. *See* Price-Anderson Nuclear Liability Act of 1957, Pub. L. No. 85–256, 71 Stat. 576 (codified as amended in scattered sections of 42 U.S.C.).

19. *See* Michael G. Faure & Tom Vanden Borre, *Compensating Nuclear Damage: A Comparative Economic Analysis of the U.S. and International Liability Schemes*, 33 WM. & MARY ENV'T L. & POL'Y REV. 219, 220 (2008). The act subsequently has been amended, however, to replace the government-funded level with "retrospective premiums" financed by all American nuclear operators. *Id.* at 243. FDIC deposit insurance represents another form of publicly subsidized insurance. Banks pay the FDIC premiums for deposit insurance, which protects the banks and their depositors from the risk of "runs." *About Page of the Federal Deposit Insurance Corporation*, FED. DEPOSIT INS. CORP.,

The cost to taxpayers of paying for such publicly subsidized insurance could be huge.[20] This Article examines how risk securitization—a relatively recent and innovative private-sector means of insuring certain otherwise uninsurable risks—could help to reduce that cost by privately insuring pandemic-related risks.[21] Originally developed to respond to certain natural disasters that occurred in the early- to mid-1990s, including Hurricane Andrew and the Northbridge Earthquake,[22] risk securitization has been used to hedge catastrophic risks that insurance and reinsurance markets may be incapable or unwilling to bear alone[23] by allocating those risks to sophisticated global investors who choose to purchase catastrophe (CAT) bonds.[24]

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https://www.fdic.gov/about/what-we-do/index.html   [https://perma.cc/9C2P-4VV2].   The   FDIC guarantees the depositors even if the premiums are insufficient. *See* 12 U.S.C § 1825(d) ("The full faith and credit of the United States is pledged to the payment of any obligation issued after [the date of the enactment of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989] by the [FDIC] . . . ."). The Terrorism Risk Insurance Act (TRIA) represents another example of publicly subsidized insurance. Pub. L. No. 107-297, 116 Stat. 2322 (2002). Because terrorist attacks are difficult to predict and have potentially devastating losses, private insurance companies are unwilling to insure against their risk. NAT'L ASS'N INS. COMM'RS, ISSUE BRIEF: TERRORISM RISK INSURANCE (May 2019), https://content.naic.org/sites/default/files/inline-files/government_relations_terrorism_risk_insurance.pdf [https://perma.cc/DC35-HKWX]. The TRIA requires primary insurers to offer terrorism coverage, but caps their potential losses and provides government funds for losses above the cap (effectively, the government acts as a kind of reinsurer for terrorism insurance policies). Thomas Russell & Jeffrey E. Thomas, *Government Support for Terrorism Insurance*, 15 CONN. INS. L.J. 183, 187 (2008).

20.   *See* Jackson & Schwarcz, *supra* note 2. *Cf.* Jeffrey C. Dobbins, *Promise, Peril, and Procedure: The Price-Anderson Nuclear Liability Act*, 70 HASTINGS L.J. 331, 334 (2019) (suggesting that the American public may be exposed to huge risk because although the Price-Anderson Act requires nuclear operators to provide $13.8 billion of insurance coverage for nuclear accidents, the nuclear catastrophes of Chernobyl and Fukushima cost as much as $500 billion each).

21.   *See* Paul U. Ali, *Risk Securitization*, *in* STEVEN L. SCHWARCZ, STRUCTURED FINANCE: A GUIDE TO THE PRINCIPLES OF ASSET SECURITIZATION 12-1–12-22 (Adam D. Ford ed., 3d. ed. 2002).

22.   INNOVATIONS IN SECURITISATION 36 (Jan Job De Vries Robbe & Paul U. Ali eds., 2006). In 2005, for example, a total of $1.99 billion debt securities were issued worldwide in securitizations of catastrophic risk, covering risk events such as European windstorms, Japanese earthquakes, U.S. earthquakes and U.S. hurricanes. The originators included insurance companies, such as USAA and Zurich American, and reinsurance companies, such as Munich Re and Swiss Re. *See* MMC SECURITIES, THE CATASTROPHE BOND MARKET AT YEAR-END 2005: RIPPLE EFFECTS FROM RECORD STORMS 17–19 (2006).

23.   *See* Neil A. Doherty & Harris Schlesinger, *Insurance Contracts and Securitization*, 69 J. RISK & INS. 45, 45–46 (2002); J. David Cummins, Neil A. Doherty & Anita Lo, *Can Insurers Pay for the "Big One"? Measuring the Capacity of the Insurance Market to Respond to Catastrophic Losses*, 26 J. BANKING & FIN. 557, 558–59 (2002) (the foregoing sources observing that a series of catastrophes on the scale of Hurricane Katrina or the 9/11 terrorist attack occurring in quick succession could overwhelm the insurance and reinsurance markets, leading to the insolvency of some insurers and reinsurers and placing considerable stress on the market survivors and governments to cover the losses from those disasters). *But cf.* Steve Evans, *First Terrorism CAT Bond Oversubscribed: Pool Re*, ARTEMIS (Feb. 26, 2019) https://www.artemis.bm/news/first-terrorism-risk-cat-bond-oversubscribed-pool-re/ [https://perma.cc/6NX9-RB7P] (discussing terrorism-related risk securitization).

24.   CAT bonds are sometimes referred to as a type of insurance-linked securities, or "ILS." *See Insurance-linked   Securities*,   NAT'L   ASS'N   INS.   COMM'RS,

Using risk securitization to hedge pandemic-related risks would raise various novel legal challenges. Certain of these challenges parallel—but due to the differences between traditional and risk securitization, are more complex than—the challenges of structuring traditional securitization transactions. These include establishing a bankruptcy-remote special purpose vehicle (SPV) and mandating its governance scheme; issuing the CAT bonds in compliance with applicable law, including securities law, disclosure and the need for transparency, and investment-company restrictions; obtaining credit ratings for those bonds; and implementing a senior-subordinate structure to provide credit enhancement.[25] Other challenges involve issues of first impression. Because the SPV's indemnifying the insurer resembles reinsurance, should the SPV be regulated as a reinsurer? Would the requirement that businesses purchase pandemic insurance raise constitutional challenges, as did the Affordable Care Act's individual mandate to purchase health insurance or pay a penalty?[26] And what should be the relative priority of any public-private risk sharing, such as the pandemic-insurance government risk sharing recently proposed by Chubb, the world's largest publicly traded property-and-casualty insurance company.[27]

Because risk securitization works by allocating risk to CAT bond investors,[28] the success of using risk securitization to hedge pandemic-related risks will depend on investor demand to purchase pandemic-related CAT bonds (PCAT bonds).[29] Capital market investors have shown high demand, for two reasons. First, CAT bonds provide a diversified return because natural catastrophes occur randomly and are not correlated with standard economic risks;[30] therefore, CAT bond returns are largely

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https://content.naic.org/cipr_topics/topic_insurancelinked_securities.htm   [https://perma.cc/LBG2-YFMK] (stating that "catastrophe bonds remain the dominant type of outstanding ILS").

25.   *See infra* Section II.A.

26.   *See infra* notes 232–240 and accompanying text.

27.   *See About Chubb*, CHUBB, https://www.chubb.com/us-en/about-chubb/ [https://perma.cc/J93H-RSXX].

28.   *See supra* notes 23–24 and accompanying text.

29.   Although that success also will depend on there being sufficient customer demand to purchase pandemic insurance, this Article contemplates governments requiring businesses to purchase that insurance. *See supra* note 3 and accompanying text; *infra* Section II.D.

30.   *Cf. infra* notes 49–54 and accompanying text (explaining why even pandemic-related CAT bonds can provide a diversified return, notwithstanding that pandemics can trigger economic downturns).

uncorrelated to the returns of equity securities and conventional corporate bonds.[31] Second, CAT bonds have "provided strong returns" to investors.[32]

As will be shown, however, CAT bonds do not represent a win-win deal for investors. If the covered catastrophe occurs, investors may lose part or all of their investment in those bonds.[33] To date, however, the combination of diversified and strong returns has more than offset investor perception of that risk. The "CAT bond market has seen strong growth," and "the amount of outstanding CAT bonds more than doubled between 2010 and 2017."[34] As this Article is being written, Moody's reports that CAT bond issuance is "surging."[35] The Article does not claim, though, that risk securitization will be sufficient to fully hedge pandemic-related risks, merely that it could offer at least a significant partial hedge.[36]

The Article proceeds as follows. Part I examines how to structure risk-securitization transactions to cover pandemics. Section A analyzes, theoretically, how those transactions should be structured. Section B then compares that theory with actual precedents for non-pandemic risk securitizations and the one precedent, structured atypically by the World Bank using government donations, for pandemic risk securitization. Section

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31.   *See* Christopher M. Lewis & Peter O. Davis, *Capital Market Instruments for Financing Catastrophe Risk: New Directions?*, 17 J. INS. REGUL. 110, 114 (1998); Angelika Schöchlin, *Where's the Cat Going? Some Observations on Catastrophe Bonds*, 14 J. APPLIED CORP. FIN. 100, 102–103 (2002). In principle, therefore, catastrophe bonds follow modern portfolio theory, which focuses on optimizing investment returns through portfolio diversification. *See* PAUL U. ALI, GEOFREY P. STAPLEDON & MARTIN L. GOLD, CORPORATE GOVERNANCE AND INVESTMENT FIDUCIARIES 87–88 (2003). According to that theory, the extent to which an investor can optimize its returns (that is, maximize overall portfolio returns for a given level of risk or minimize the risk borne by the portfolio for a given level of returns) depends upon the extent to which the returns of the different portfolio constituents are correlated to one another. *Id.* In general, the addition to a portfolio of securities whose returns are negatively or weakly correlated, or uncorrelated, to the existing constituents of the portfolio should increase overall portfolio returns (while leaving the riskiness of the portfolio unchanged) or lower the portfolio's riskiness (while leaving the portfolio's overall returns unchanged). *Id.* at 88. *See generally* ALTERNATIVE RISK STRATEGIES 549–552 (Morton Lane ed., 2002).

32.   Andy Polacek, *Catastrophe Bonds: A Primer and Retrospective*, FED. RSRV. BANK CHI. (2018), https://www.chicagofed.org/publications/chicago-fed-letter/2018/405 [https://perma.cc/5YLP-A6MS]. *Cf.* PARTNER REVIEWS, THE DRIVERS OF CATASTROPHE BOND PRICING 3 (2015), https://partnerre.com/wp-content/uploads/2017/08/Catastrophe-Bond-Pricing.pdf [https://perma.cc/AU6M-G4T4] (plotting the historic spread of CAT bonds against that of High Yield BB Corporate Bonds from 2000 to 2015).

33.   *See infra* Section I.A (discussing the subordination of CAT bond repayment to the insurer's right to indemnification).

34.   Polacek, *supra* note 32.

35.   *Catastrophe Bond Issuance Surging as Reinsurance Pricing Moves Higher*, MOODY'S (June 30, 2020), https://www.moodys.com/search?keyword=Catastrophe%20bond%20issuance%20surging%20as%20reinsurance%20pricing%20moves%20higher%20 (reporting that the CAT bond market "has already shown tremendous growth in the first half of 2020"). *Cf. infra* notes 251–254 and accompanying text (further discussing the growth of the CAT bond market).

36.   *Cf. infra* notes 397–402 and accompanying text (discussing the need for ex post mitigative measures).

C then builds on that comparison to identify future challenges for structuring risk securitization to cover pandemic-related risks. Thereafter, Part II of the Article attempts to resolve the future legal challenges, and Part III attempts to resolve the future economic challenges (and also provides a cost-benefit analysis).

I. STRUCTURING RISK SECURITIZATION FOR PANDEMICS

To examine how to structure risk-securitization transactions to cover pandemics, this Article starts by analyzing, theoretically, how those transactions should be structured.

A. Theory

Conceptually, risk securitization could work as follows. An insurance company, reinsurer, government catastrophe fund,[37] or other entity (for simplicity, each an "insurer") that wishes to insure parties suffering the catastrophic risks of an extreme event, such as an earthquake or hurricane[38] but potentially including a pandemic, would create an SPV to issue CAT bonds to capital market investors.[39] The SPV would invest the proceeds of its bond issuance in liquid and highly rated debt securities, including U.S. Treasury money-market instruments.[40] In exchange for premium payments

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37. These include, for example, the California Earthquake Authority, CAL. INS. CODE § 10089.6 (Deering 2020) and the Florida Hurricane Catastrophe Fund, FLA. STAT. ANN. § 215.555 (LexisNexis 2020). The California Earthquake Authority (CEA) is a publicly managed, privately funded, nonprofit entity that provides primary earthquake insurance coverage throughout California. *See History of the California Earthquake Authority*, CAL. EARTHQUAKE AUTH., https://www.earthquakeauthority.com/About-CEA/CEA-History [https://perma.cc/MY7A-PMKX]. Although the CEA does not currently sponsor CAT bond issuance, it sometimes invests in CAT bonds. *See, e.g.*, Steven Evans, *CEA Targets $400m of Reinsurance with First Ursa Re Cat Bond of 2019*, ARTEMIS (Nov. 7, 2019), https://www.artemis.bm/news/cea-targets-400m-of-reinsurance-with-first-ursa-re-cat-bond-of-2019/ [https://perma.cc/4NXM-TCJ2]. The Florida Hurricane Catastrophe Fund (FHCF) is a tax-exempt, state trust fund, funded through premiums collected from primary insurers, investment earnings, and emergency assessments on Florida property and casualty insurers. Richard C. Mason, William C. O'Niell, John D. LaBarbera & William K. Broud, *Recent Developments in Excess, Surplus Lines, and Reinsurance*, 43 TORT TRIAL & INS. PRAC. L.J. 375, 406 (2008); *Florida Hurricane Catastrophe Fund*, FLA. STATE BD. ADMIN., https://www.sbafla.com/fhcf/Home.aspx [https://perma.cc/K7YB-BVD7]. The FHCF provides reinsurance for catastrophic hurricanes affecting Florida. Christine L. Agnew, *Come Hell and High Water: Can the Tax Code Solve the Post-Katrina Insurance Crisis?*, 11 LEWIS & CLARK L. REV. 701, 729 (2007).

38. *Cf. infra* note 22 and accompanying text (discussing risk securitization's original application to earthquakes and hurricanes).

39. *See* Polacek, *supra* note 32. In the author's experience, most SPVs are organized as wholly owned subsidiaries of the sponsor—here, the insurer—so that any surplus value remaining in the SPV once the CAT bonds are paid would belong to the sponsor. *Cf.* SCHWARCZ, *supra* note 21, §§4:8–4:9. For a broader analysis of insurers using captive subsidiaries to provide reinsurance, see Schwarcz & Schwarcz, *supra* note 15, at 1624–25.

40. *See* Polacek, *supra* note 32.

(also known as indemnification or guarantee fees), the SPV—acting effectively as a special purpose reinsurer[41]—would promise to indemnify the insurer[42] should the extreme event, e.g., a pandemic of specified magnitude, occur.[43] The CAT bonds would bear interest based not only on the SPV's investment returns but also on its receipt of the premium payments.[44] Repayment of the CAT bonds would be subordinated, however, to the insurer's right to indemnification, subjecting the investors to a potential loss of principal and/or interest under those bonds.[45] In this way, risk securitization utilizes the deep pockets of the global capital markets, which have a far greater capacity than the global insurance and reinsurance markets, to absorb catastrophic risks.[46] Credit enhancement, possibly by issuing differing internal-priority classes (sometimes called tranches) of CAT bonds under a senior-subordinate structure, could even broaden the capital-market investor base.[47]

Schematically, a risk-securitization transaction would have the following representative elements.[48]

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41.   *Cf.   Reinsurance*,   NAT'L   ASS'N   INS.   COMM'RS, https://content.naic.org/cipr_topics/topic_reinsurance.htm   [https://perma.cc/9BHB-LX87] ("Reinsurance, often . . . referred to as 'insurance [of] insurance companies,' is a contract of indemnity between a reinsurer and an insurer.").

42.   The legal form of the indemnification could be multifold, including a surety bond or even a credit-default swap (CDS). Generically, however, the indemnification is a basic guarantee. *Cf.* Steven L. Schwarcz, *Regulating Derivatives: A Fundamental Rethinking*, 70 DUKE L.J. 545, 555–56 (2020) (explaining why CDS derivatives are basic guarantees). If a CDS is used as the indemnification contract, the risk securitization structure would resemble a synthetic collateralized-debt obligation (CDO) transaction. *Cf.* James Chen, *Synthetic Collateralized Debt Obligation (CDO)*, INVESTOPEDIA (Mar. 30, 2020),   https://www.investopedia.com/terms/s/syntheticcdo.asp   [https://perma.cc/ZJ9J-RTM5] (explaining that transaction).

43.   *See* Polacek, *supra* note 32.

44.   *See id.*

45.   *See id.*

46.   *See* Neil A. Doherty, *Financial Innovation in the Management of Catastrophe Risk*, 10 J. APPLIED CORP. FIN. 84, 84 (1997); Johannes Skylstad Tynes, *Catastrophe Risk Securitization*, 19 J. INS. REGUL. 3, 7–8 (2000). *Cf.* Polacek, *supra* note 32 ("By attracting alternative sources of capital (e.g., hedge funds, sovereign wealth funds, pension funds, and mutual funds) to compete with traditional reinsurance . . . , CAT bonds exert downward pressure on reinsurance prices (and price volatility) while increasing the total capital available for the transfer of insurance risks."). For instance, the global capital markets, with approximately $106 trillion of bonds outstanding in 2020, *see infra* note 297 and accompanying text, are many times larger than the global reinsurance market, with capital of $402.35 billion in 2020. *See Global Reinsurance Market Estimated to Grow by $32+ Billion over 2020-2021*, GLOBENEWSWIRE   (Jan.   27,   2021,   7:08   PM),   https://www.globenewswire.com/news-release/2021/01/27/2164954/0/en/Global-Reinsurance-Market-Estimated-to-Grow-by-32-Billion-Over-2020-2021-Companies-Rearranging-Their-Operations-Amid-COVID-19.html [https://perma.cc/CD9C-N8G2].

47.   *See infra* Section II.A.5.

48.   The author thanks Andrew DeJoy, Duke Law Class of 2022, for help in preparing this schematic diagram.

Catastrophe Insurance
-------------------------------------►

INSURER   **INSURED PARTIES**

Premium Payments $
◄-------------------------------------

Indemnification | | Premium
of Insurer | | Payments $
by SPV | |

                ▼   Issuance by SPV of CAT Bonds[50]

-------------------------------------►

SPV   **CAPITAL MARKET INVESTORS**

| Payment for CAT Bonds $$$
| ◄-------------------------------
$$$$ -------------------------------►
| Repayment of CAT Bonds (subordinated to Insurer indemnification)
▼

*Investment of CAT-Bond-Payment Proceeds + Premium Payments
in Liquid & Highly-rated Debt Securities*

   In theory, CAT bonds should provide investors with a diversified return because natural catastrophes occur randomly and thus are not correlated with standard economic risks.[49] That certainly is true for hurricanes, earthquakes, and other natural disasters that occur within a specific geographical region and within a specific period of time.[50] For example, when stock markets plummeted and corporate bonds defaulted during the 2008 global financial crisis (the "global financial crisis"), the Swiss Re CAT bond index rose 2.5%.[51] Even in 2020, when news of the COVID-19 pandemic severely impacted the pricing of several classes of investments, CAT bonds were largely immune to the volatility.[52] Rating agency Standard

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49.   *See* Polacek, *supra* note 32.
50.   *See infra* note 101, at 2.
51.   Steve Johnson, *Catastrophe Bonds Prove Anything but a Disaster*, FIN. TIMES (June 2013), https://www.ft.com/content/bc897de0-c7a0-11e2-be27-00144feab7de.
52.   Steve Evans, *Covid-19 Pandemic "Showcased" Value of Cat Bonds to Investors: S&P*, ARTEMIS (May 19, 2020), https://www.artemis.bm/news/covid-19-pandemic-showcased-value-of-cat-

& Poor's announced that The COVID-19 pandemic has showcased the value of publicly traded Cat Bonds to investors, offering a liquid asset class that was not correlated with the (then-current) volatile financial markets.[53]

These data do not, however, generally reflect the pricing of PCAT bonds because the only such bonds were those of the PEF and their outstanding principal was relatively small. Logically, the occurrence of a pandemic that is covered by PCAT bonds would negatively impact their value.[54] At the same time, the pandemic could cause a much broader and deeper financial decline than natural disasters such as hurricanes and earthquakes.[55]

That does not mean that PCAT bonds cannot provide investors with a diversified return. Like other natural disasters, pandemics occur randomly; they certainly are not caused, for example, by stock market declines.[56] Therefore, absent a pandemic, there would be no correlation during the normal life of PCAT bonds between their value and financial sector conditions. If there were a pandemic, there could well be a correlation.[57] However, PCAT investors explicitly bargain to take that risk: they agree to subordinate their right to repayment of the PCAT bonds to the indemnification rights of pandemic insurers.[58]

Next, compare the foregoing theory with actual precedents for non-pandemic risk securitizations and the one precedent, structured atypically by the World Bank using government donations, for pandemic risk securitization.

B. Precedent

The foregoing theoretical analysis helps to explain the structure of risk-securitization transactions, the parties involved with those transactions, and

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bonds-to-investors-sp/ [https://perma.cc/BAV8-HV3D]. The series of PEF PCAT bonds that covered coronavirus pandemics was severely impacted, though. *See infra* note 54.

53.   *Credit FAQ: In a Correlated Market, Catastrophe Bonds Stand Out*, S&P GLOB. (May 18, 2020),   https://www.spglobal.com/ratings/en/research/articles/200518-credit-faq-in-a-correlated-market-catastrophe-bonds-stand-out-11491720.

54.   For example, the value of the riskier tranche of the World Bank's pandemic catastrophe bonds (discussed *infra* Section I.B) was down 40% as of February 25, 2020. Tasos Vossos, *Catastrophe Bonds Signal Coronavirus Nearing Pandemic Status*, BNN BLOOMBERG (Feb. 25th, 2020), https://www.bnnbloomberg.ca/catastrophe-bonds-signal-coronavirus-nearing-pandemic-status-1.1395384 [https://perma.cc/24D9-67FX].

55.   *Cf.* Jackson & Schwarcz, *supra* note 2, at 195 (observing that pandemics can impose widespread economic disruptions of an unpredictable duration, and that even rigorous regulatory interventions might not be economically and politically feasible to fully insulate the financial system).

56.   *Cf. supra* notes 49–50 and accompanying text (discussing natural disasters).

57.   In this context, it should be noted that pandemic risk, unlike normal hurricane and earthquake risk, is also globally correlated. *See supra* note 12 and accompanying text. *Cf.* Weinberger, *supra* note 11 (observing "the geographic scope and magnitude of the risks"). Presumably, PCAT investors would price in that correlated risk.

58.   *See supra* note 45 and accompanying text.

their motivations. Risk-securitization transactions, however, are not merely theoretical; tens of billions of dollars of CAT bonds are already outstanding.[59] This section examines representative actual transactions, starting with traditional risk-securitization transactions that insure hurricanes and earthquakes and then discussing the one pandemic risk-securitization transaction to date (and explaining how it differs from the traditional transactions).

The Citrus Re transaction sponsored by Heritage Insurance typifies a risk-securitization precedent for hurricane risk. Heritage Insurance offers property-and-casualty insurance policies within the hurricane-prone state of Florida.[60] In 2015, Heritage entered into an agreement with its SPV reinsurer, Citrus Re Ltd.,[61] wherein Citrus Re agreed to indemnify Heritage for certain insurance payments resulting from named storms affecting Florida.[62] To help provide that reinsurance, Citrus Re issued $277.5 million of 3-year maturity Series 2015-1 CAT bonds.[63] During the three-year risk period, Heritage paid Citrus Re Ltd. a periodic premium while Citrus Re held the $277.5 million proceeds of the bond issuance, which it invested in U.S. Treasury money-market instruments,[64] to indemnify Heritage should the bonds be triggered.[65] The CAT bonds covered named storms affecting Florida, had an indemnity trigger, and were issued in three classes: $150 million of Class A, $97.5 million of Class B, and $30 million of Class C.[66] The Class A bonds were the least risky, with an expected loss of 1.22%, and were priced at 4.75%.[67] The Class B bonds had a higher expected loss, of

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59. *See infra* notes 253–254 and accompanying text.

60. *See About Heritage Property & Casualty Company*, HERITAGE INS., https://www.heritagepci.com/company/about-us/ [https://perma.cc/75AT-GXDA].

61. Citrus Re Ltd. is organized under Bermuda law as a special purpose insurer, or SPI. *Citrus Re Ltd. (Series 2015-1)*, ARTEMIS, https://www.artemis.bm/deal-directory/citrus-re-ltd-series-2015-1/ [https://perma.cc/5FD9-5S4Q]. For accounting purposes, Citrus Re appears to be a variable interest entity, in which Heritage has a controlling interest despite not having a majority of voting rights. *See* Heritage Ins. Holdings, Inc., SEC Quarterly Report (Form 10-Q), at 19 (May 8, 2015), https://investors.heritagepci.com/~/media/Files/H/Heritage-IR/quarterly-results/2015/sec/hrtg-1q15-10q.pdf [https://perma.cc/L8FK-2JU4] [hereinafter SEC Quarterly Report].

62. *See Citrus Re Ltd. (Series 2015-1)*, ARTEMIS, *supra* note 61, at 1.

63. *See id.* at 3. These CAT bonds were called "notes," but there is no legal distinction between notes and bonds: both are promissory notes. To avoid confusion, this Article will refer to these "notes" as bonds.

64. AON SEC., INSURANCE-LINKED SECURITIES: ALTERNATIVE CAPITAL BREAKS NEW BOUNDARIES 60 (2017), http://thoughtleadership.aonbenfield.com/Documents/20170907-securities-ils-annual-report.pdf [https://perma.cc/3DMD-3FCQ].

65. *See* SEC Quarterly Report, *supra* note 61, at 19. Structurally, Citrus Re held those proceeds in a reinsurance trust account for the benefit of Heritage. *See id.*

66. *Id.*

67. *See Citrus Re Ltd. (Series 2015-1)*, ARTEMIS, *supra* note 61, at 2. For an analysis of structuring the relative riskiness of the Class A, B, and C bonds, see *infra* note 198 and accompanying text.

2.44%, and were priced higher—at 6%.[68] Finally, the Class C notes were the riskiest, with an expected loss of 5.05%, and were priced the highest— at 9%.[69]

The structure of the Citrus Re transaction is consistent with the representative schematic previously discussed.[70] In return for indemnification by Citrus Re, an SPV acting effectively as a special purpose reinsurer, the insurer (Heritage) made premium payments to Citrus Re, which in turn issued CAT bonds to fund its indemnification obligation. The proceeds of the bond issuance were invested in liquid and highly rated debt securities (in this case, U.S. Treasury money market instruments). Citrus Re used the premium payments and the interest earned on investment to make interest payments to the CAT bond investors. The right of the investors to be repaid was subordinated to the right of Heritage to be indemnified.[71]

The Muteki Ltd. three-hundred-million-dollar CAT bond transaction sponsored by the Japanese insurance cooperative Zenkyoren (or JA Jyosai) typifies a risk-securitization precedent for earthquake risk. The bonds were issued by Muteki Ltd., an SPV sponsored by reinsurance giant Munich Re.[72] Muteki Ltd. indemnified Munich Re, which in turn reinsured Zenkyoren's exposure on earthquake insurance.[73] The insurance would trigger in the event of an earthquake in Japan with a magnitude above a certain threshold.[74] The bonds were rated Ba2 by Moody's and priced at LIBOR + 4.4%.[75]

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68.   *See Citrus Re Ltd. (Series 2015-1)*, ARTEMIS, *supra* note 61, at 2.

69.   *See id.*

70.   *See supra* schematic diagram accompanying notes 47–49.

71.   Unfortunately for investors, the Class B and C bonds were both triggered by Hurricane Irma in 2017. *See Insurance-Linked Securities Market Update*, 30 SWISS RE, 1, 10 (2019) https://www.swissre.com/dam/jcr:7467c134-2803-42f3-8a2f-cc2e9e156c34/ils-market-yearend-february-2019.pdf [https://perma.cc/UBR5-U7LV]. All $30 million of the Class C bond fund and approximately $94.5 million of the Class B note fund was paid out to Heritage Insurance to cover losses caused by the hurricane. *See Catastrophe Bond Losses: Cat Bonds Defaulted, Triggered, or at Risk*, ARTEMIS, https://www.artemis.bm/cat-bond-losses/ [https://perma.cc/5L89-2DJY].

72.   *See* THE WORLD BANK, LEARNING FROM MEGADISASTERS: LESSONS FROM THE GREAT EAST JAPAN EARTHQUAKE 260 (Federica Renghieri & Mikio Ishiwatari eds., 2014), https://www.gfdrr.org/sites/default/files/publication/Learning%20from%20Megadisasters%20%20Lessons%20from%20the%20Great%20East%20Japan%20Earthquake.pdf [https://perma.cc/4GU8-D89Y].

73.   *See Rating Action: Moody's Downgrades Muteki Ltd. Series 2008-1, a Catastrophe Bond Program Exposed to Japan Earthquake*, MOODY'S INV. SERV. (Mar. 31, 2011), https://www.moodys.com/research/Moodys-downgrades-Muteki-Ltd-Series-2008-1-a-catastrophe-bond?docid=PR_216840 [https://perma.cc/V37V-ZWVN].

74.   *See Muteki Ltd.*, ARTEMIS, https://www.artemis.bm/deal-directory/muteki-ltd/ [https://perma.cc/N4K8-QHUM] (discussing the parametric payout as "triggered by the location and peak ground acceleration of earthquakes as reported by a network of seismographs").

75.   *Id.* All three hundred million dollars were paid out to the sponsor Zenkyoren after a March 11, 2011 earthquake off the coast of Tohoku, Japan exceeded the payout trigger. *Muteki Ltd. Catastrophe Bond Triggered by Japan Earthquake Confirmed as Total Loss*, ARTEMIS (May 7, 2011),

The structure of the Muteki Ltd. transaction is likewise consistent with the representative schematic previously discussed.[76] It has only two differences from the representative schematic, and neither is substantive. One difference is that whereas the SPV in the representative schematic effectively reinsures the insurer, the SPV in the Muteki Ltd. transaction effectively reinsures Munich Re which in turn reinsures the insurer. The other difference is that whereas the proceeds of the CAT bond issuance in the representative schematic were invested in liquid and highly rated debt securities, the proceeds of the Muteki Ltd. CAT bond issuance were, consistent with many similar CAT bond transactions at that time (although no longer done), invested in a total-return-swap transaction.[77]

The only risk-securitization precedent for pandemic-related risk is the Pandemic Emergency Financing Facility (PEF), arranged by the International Bank for Reconstruction and Development (World Bank) in June 2017. Spurred by the 2014 Ebola epidemic in West Africa,[78] the PEF was designed to help fund developing countries facing the risk of a pandemic.[79] The PEF was capitalized with more than $500 million, consisting of a "combination of [PCAT] bonds and derivatives [aggregating $425 million] priced today, a cash window, and future commitments from donor countries for additional coverage."[80] Three-hundred-twenty million

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https://www.artemis.bm/news/muteki-ltd-catastrophe-bond-triggered-by-japan-earthquake-confirmed-as-total-loss/ [https://perma.cc/LN8R-JDWM].

76. *See supra* note 70 and accompanying text.

77. *See* Sarah Hills, *Cat Bond Market Develops New Collateral Trends*, REUTERS (Jan. 26, 2010, 8:38 AM), https://www.reuters.com/article/us-catbonds-collateral-analysis/cat-bond-market-develops-new-collateral-trends-idUSTRE60P3RC20100126 [https://perma.cc/T7P5-TDKX] (reporting that before the global financial crisis, many SPVs issuing CAT bonds used banks as "total return swap" counterparties to hold the proceeds from the bond sale). The collapse of Lehman Brothers in 2008 exposed the risk of this form of investment. *The Death of the Total Return Swap in the Cat Bond Market Is Almost Upon Us*, ARTEMIS (Feb. 12, 2013), https://www.artemis.bm/news/the-death-of-the-total-return-swap-in-the-cat-bond-market-is-almost-upon-us/ [https://perma.cc/QTD3-CTLW].

78. *See* World Bank Press Release, World Bank Launches First-Ever Pandemic Bonds to Support $500 Million Pandemic Emergency Financing Facility (June 23, 2017), https://www.worldbank.org/en/news/press-release/2017/06/28/world-bank-launches-first-ever-pandemic-bonds-to-support-500-million-pandemic-emergency-financing-facility [https://perma.cc/4RNP-8YXV] [hereinafter World Bank Press Release] (discussing the need to make funds more quickly available to developing nations to combat the spread of viruses).

79. *Id.*

80. *Id.* More technically, the PEF was "supported by the Pandemic Emergency Financing Facility Trust Fund (the 'PEF Trust Fund'), which is established and administered by [the World Bank] as trustee . . . . The PEF Trust Fund will operate as a financial intermediary fund to make funds available to PEF-eligible Countries and eligible responding agencies . . . ." WORLD BANK GRP., PROSPECTUS SUPPLEMENT PT-74 (2017), http://pubdocs.worldbank.org/en/882831509568634367/PEF-Final-Prospectus-PEF.pdf [https://perma.cc/Z5WB-FGJ2] [hereinafter WORLD BANK PROSPECTUS SUPPLEMENT]. Furthermore, the PEF Trust Fund was not actually funded by bond proceeds until a covered pandemic occurred. *Id.* at PT-75.

dollars of PCAT bonds were issued,[81] consisting of $225 million Class A bonds and $95 million Class B bonds.[82] The then World Bank Group President Jim Yong Kim announced that the PEF "creates an entirely new market for pandemic risk insurance."[83]

The Class A and Class B bonds each had three-year maturities but differed in the types of viruses covered and therefore the amount of risk entailed.[84] The Class A bonds covered Flu and Coronavirus pandemics and offered an interest rate of six-month LIBOR plus (generally) 6.5%.[85] The Class B bonds covered Coronavirus, Filovirus, Crimean Congo Hemorrhagic Fever, Lassa Fever, and Rift Valley Fever pandemics and offered an interest rate of six-month LIBOR plus (generally) 11.1%.[86] For each class, payments made by the PEF on behalf of covered pandemics would subtract from principal and interest due on the bonds of that class.[87]

Notwithstanding that risk, investor demand for the PCAT bonds was strong, evidenced by the bond issue being oversubscribed by 200%.[88] In part, that demand no doubt reflects those bonds' extraordinary yield.[89] As of the PCAT bond-issuance date, June 28, 2017, the six-month LIBOR was 1.45%,[90] while the rate for a three-year Treasury note was 1.51%[91] and the three-year High Quality Market (HQM) Corporate Bond Spot Rate was 2.04%.[92] Therefore, when issued, the Class A bonds had a credit spread of approximately 6.44% over three-year Treasury notes[93] and bore interest that was 5.91% over the yield on three-year HQM Corporate Bonds.[94] The Class

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81.   The relevant offering-related disclosure does not make it clear whether the issuer was the PEF itself or the World Bank.

82.   WORLD BANK PROSPECTUS SUPPLEMENT, *supra* note 80, at cover page. Technically, the Class A and Class B Bonds were labeled "Floating Rate Catastrophe-Linked Capital at Risk Notes." *Id.*

83.   World Bank Press Release, *supra* note 78.

84.   *See* WORLD BANK PROSPECTUS SUPPLEMENT, *supra* note 80, at PT-21–22.

85.   *See id.* at PT-11.

86.   *See id.* at PT-11–12.

87.   *See id*. at PT-2, PT-48, PT-75.

88.   World Bank Press Release, *supra* note 78.

89.   The yield on the PEF's PCAT bonds was comparable, however, to that of other CAT bonds. ARTEMIS, Q3 2017 CATASTROPHE BOND & ILS MARKET REPORT: PARAMETRICS DOMINATE AN AVERAGE BUT DIVERSE QUARTER 11 (2017), https://www.artemis.bm/wp-content/uploads/2018/01/q3-2017-cat-bond-ils-market-report.pdf?utm_source=ReportsPage&utm_medium=Link&utm_content=Q32017Report&utm_campaign=Report [https://perma.cc/JM7V-7CC5] (reporting that 25% of insurance-linked securities issued in Q3 2017 offered coupon rates of 9% or more).

90.   *6-Month London Interbank Offered Rate (LIBOR), Based on U.S. Dollar*, FED. RSRV. BANK ST. LOUIS, https://fred.stlouisfed.org/series/USD6MTD156N [https://perma.cc/QAM6-VLZK].

91.   U.S. DEP'T TREASURY, DAILY TREASURY YIELD CURVE RATES (June 28, 2017), https://www.treasury.gov/resource-center/data-chart-center/interest-rates/pages/TextView.aspx?data=yieldYear&year=2017 [https://perma.cc/4BSE-BJVE].

92.   *See 3-year High Quality Market (HQM) Corporate Bond Spot Rate*, FED. RSRV. BANK ST. LOUIS, https://fred.stlouisfed.org/series/HQMCB3YR [https://perma.cc/FS49-QB4U].

93.   6.5% + 1.45% = 7.95%; 7.95% - 1.51% = 6.44%.

94.   6.5% + 1.45% = 7.95%; 7.95% - 2.04% = 5.91%.

B bonds had a credit spread of approximately 11.04% over three-year Treasury notes[95] and bore interest that was 10.51% over the yield on three-year HQM Corporate Bonds.[96]

The PEF had two so-called "windows": an insurance window and a cash window.[97] The insurance window constituted "parametric" insurance, which does not indemnify the actual loss but, instead, pays a preset amount upon the occurrence of the triggering event—which is usually a catastrophic natural event.[98] Parametric insurance is especially appropriate for pandemics because payouts need to happen quickly to make a difference to businesses trying to pay their employees in the midst of stay-at-home orders.[99]

Under the PEF insurance window, once a covered virus reached a predetermined pandemic level, the preset payout for that virus would be dispersed.[100] The payout amounts were estimated to approximate the loss, dispensing with the need for insured countries to prove actual losses.[101] The premiums for the PEF insurance were funded by donations, principally from Australia, Germany, and Japan.[102]

The cash window was an account that could be drawn on by insured countries that were suffering covered diseases but had not yet met the requirements for a payout under the insurance window.[103] This account was also funded by donations.[104]

Because the PEF was largely funded by donations and thus not an arm's length commercial project, one might question the World Bank president's claim that the PEF creates an "entirely new market" for pandemic-risk insurance.[105] The answer is complicated. From the perspective of whether the premiums on that insurance were commercially viable, the World Bank

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95. $11.1\% + 1.45\% = 12.55\%$; $12.55\% - 1.51\% = 11.04\%$.

96. $11.1\% + 1.45\% = 12.55\%$; $12.55\% - 2.04\% = 10.51\%$.

97. *See* World Bank Press Release, *supra* note 78.

98. Daniel Brettler & Timothy Gosnear, *Parametric Insurance Fills Gaps Where Traditional Insurance Falls Short*, INS. J. (Jan. 9, 2020), https://www.insurancejournal.com/news/international/2020/01/09/553850.htm. [https://perma.cc/4NE6-AL6D].

99. The proposed pandemic insurance policy offered by Munich Re in collaboration with Marsh and Metabiota, for example, was also parametric. *See supra* note 10.

100. *See* World Bank Press Release, *supra* note 78.

101. *See* MOODY'S INV. SERV., CATASTROPHE BONDS METHODOLOGY 4 (June 26, 2020) [hereinafter CATASTROPHE BONDS].

102. WORLD BANK GRP., PANDEMIC EMERGENCY FINANCING FACILITY (PEF): OPERATIONAL BRIEF FOR ELIGIBLE COUNTRIES (Feb. 2019) [hereinafter PANDEMIC EMERGENCY FINANCING FACILITY (PEF)].

103. *See id.*

104. *See id.*

105. *See supra* note 83 and accompanying text.

president's claim is unjustified. Being paid by donations,[106] those premiums were not subjected to a market test. From the perspective of whether the interest rates on the Class A and Class B bonds were commercially viable, the World Bank president's claim is partly justified. It is appropriate to the extent that arm's length investors were willing to purchase those bonds, notwithstanding the risk that any payments made by the PEF on behalf of covered pandemics would subtract from the principal and interest due on those bonds.[107] It is inappropriate to the extent that, absent the occurrence of covered pandemics, repayment of those bonds was full recourse to the World Bank—as opposed to the usual limited recourse of CAT bonds.[108] Furthermore, it is unjustified to the extent that the PEF lacked a market test of whether insureds would be willing to pay premiums high enough, coupled with investments on the bond proceeds, to pay those interest rates.[109]

The PEF recently had a payout experience in response to the COVID-19 pandemic.[110] The World Bank has not renewed the PEF's insurance window.[111] The PEF therefore does not provide a clear future direction for pandemic-risk insurance.

C. Future Challenges

Notwithstanding the relative success of CAT bonds, future challenges remain to using risk securitization to protect against pandemic-related risk. There are legal challenges and economic challenges.

1. Legal challenges

Certain of the legal challenges parallel—but due to the differences between traditional and risk securitization, are more complex than—the challenges of structuring traditional securitization transactions. These

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106.   *See* PANDEMIC EMERGENCY FINANCING FACILITY (PEF), *supra* note 102, and accompanying text.

107.   *See supra* note 87 and accompanying text.

108.   The relevant offering-related disclosure does not clarify whether the PEF involved an SPV. If the World Bank itself, rather than an SPV, issued the PCAT bonds, they would be full recourse to the World Bank.

109.   *Cf. supra* note 106 and accompanying text (observing that those premiums were not subjected to a market test); *supra* note 44 and accompanying text; *infra* Section I.C (discussing how those premiums add to the amounts available to repay the investors).

110.   On April 27, 2020, the insurance window paid out $195.85 million, the maximum payout allowed for a coronavirus outbreak, in response to the COVID-19 pandemic. *Fact Sheet: Pandemic Emergency Financing Facility*, WORLD BANK GRP. (Oct. 1, 2020), https://www.worldbank.org/en/topic/pandemics/brief/fact-sheet-pandemic-emergency-financing-facility [https://perma.cc/WP5Q-LDLP]. The PEF cash window paid out over $60 million to combat outbreaks of Ebola in the Democratic Republic of Congo in 2018 and 2019. *See id.*

111.   *Id.* The PEF's PCAT bonds matured on July 15, 2020. *See id.*

include establishing a bankruptcy-remote SPV and mandating its governance scheme; issuing the PCAT bonds in compliance with applicable law, including securities law and investment-company restrictions;[112] obtaining credit ratings for those bonds; and implementing a senior-subordinate structure to provide credit enhancement. Section II.A discusses these challenges.[113]

Other legal challenges involve issues of first impression. For example, an SPV indemnifying the insurer resembles reinsurance, a regulated activity.[114] Should the SPV be regulated as a reinsurer? Would the requirement that businesses purchase pandemic insurance raise constitutional challenges, as did the Affordable Care Act's individual mandate to purchase health insurance or pay a penalty?[115] And what should be the relative priority of any public-private risk sharing? Sections II.B, II.C, and II.D discuss these more novel challenges.

2. Economic challenges

The fundamental economic challenge is developing a large enough market for PCAT bonds to enable risk securitization to fund the level of pandemic insurance that businesses should be required to purchase. That challenge raises at least four m/abstract=3516036 questions: What level of pandemic insurance should businesses be required to purchase? What is the size of the market for PCAT bonds? What pandemic-related risks should the government share (and how should it share those risks)? And would the benefits of pandemic risk securitization be likely to outweigh its costs?

Part II next examines how to resolve the legal challenges. Thereafter, Part III examines how to resolve the economic challenges.

II. RESOLVING THE LEGAL CHALLENGES

A. Legal Challenges that Parallel Traditional Securitization Transactions

Some of the legal challenges of risk securitization parallel those of traditional securitization transactions. As mentioned, however, the

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112. *Cf. infra* note 372 and accompanying text (arguing that CAT bonds should be publicly issued and traded in order to create more transparency and encourage a wider investor base).

113. There also are a range of cross-border legal challenges associated with structuring traditional securitization transactions. For a detailed discussion of those issues, see SCHWARCZ, *supra* note 21, at Chapter 8 (examining such issues as cross-border legal enforcement, currency exchange and hedging, and international taxation).

114. *See* Caroline Banton, *What is Reinsurance?*, INVESTOPEDIA (June 23, 2021), https://www.investopedia.com/ask/answers/08/reinsurance.asp [https://perma.cc/PA4W-3E5L].

115. *Infra* notes 229–231 and accompanying text.

inventive nature of risk securitization makes these challenges more complex.[116]

1. *Establishing a bankruptcy-remote SPV and mandating its governance scheme*

A fundamental legal challenge is ensuring that the bond-issuing SPV does not become subject to bankruptcy. In industry parlance, this is called achieving bankruptcy remoteness.[117] Bankruptcy remoteness is important for various reasons, including that bankruptcy law automatically would stay the SPV from repaying its bonds.[118] Rating agencies will not rate an SPV's bonds as "investment grade" absent bankruptcy remoteness,[119] and investors will be unlikely to purchase those bonds.[120]

An SPV can become subject to bankruptcy in any of three ways: by voluntarily filing for bankruptcy, by involuntarily being forced into bankruptcy, and by being substantively consolidated into the bankruptcy estate of an affiliate.[121] Consider each in turn.

The corporate governance of an entity, including an SPV, controls how the entity would voluntarily file for bankruptcy. This aspect of bankruptcy remoteness thus can be protected by establishing a governance scheme that limits the circumstances in which the SPV's directors could file a voluntary bankruptcy petition.[122] For example, an SPV's organizational documents typically require at least two independent directors to be on the board and also require a unanimous vote of all directors to authorize the filing of a voluntary bankruptcy petition.[123] Alternatively, investors in an SPV might be able to obtain special "golden" shares that allow them to prevent the SPV from voluntarily filing for bankruptcy without investor consent.[124] The golden share scheme faces tension between state corporate-governance law, which generally allows a firm to manage its internal affairs, and federal

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116. *See supra* Section I.C.1 (discussing establishment of an SPV, a governance scheme, issuance of PCAT bonds, etc.).

117. *See* STEVEN L. SCHWARCZ, STRUCTURED FINANCE, A GUIDE TO THE PRINCIPLES OF ASSET SECURITIZATION & SUPPS. 1-3 to 1-4 (Adam D. Ford ed., 3d. ed. 2002).

118. *See* Automatic Stay, 11 U.S.C. § 362.

119. *Cf. infra* notes 172–174 and accompanying text (discussing credit ratings).

120. *See, e.g.*, *How Credit Ratings Affect Bond Valuations | Bond Ratings Explained*, AM. ASS'N INDIVIDUAL INVS., https://www.aaii.com/investing/article/how-credit-ratings-affect-bond-valuations? [https://perma.cc/SCX3-39G8].

121. SCHWARCZ, *supra* note 21, at §§ 3:2, 3:3, 3:4.

122. *Id.* at § 3:2.

123. *Id.* at § 3–11.

124. *See generally* Yiming Sun, *The Golden Share: Attaching Fiduciary Duties to Bankruptcy Veto Rights*, 87 U. CHI. L. REV. 1109, 1111 (2020).

bankruptcy law, which generally restricts the waiver of the right to file a voluntary bankruptcy petition.[125]

An entity, including an SPV, can be forced into involuntary bankruptcy if it generally is not paying its debts as they come due.[126] Three or more creditors of the SPV then could file an involuntary bankruptcy petition.[127] Bondholders would be highly unlikely to want to force the SPV into bankruptcy because that would trigger the automatic stay and suspend their right to repayment.[128] Other creditors of the SPV, however, may well want to force the SPV into bankruptcy, thereby subjecting the SPV to the vagaries of bankruptcy law—which might increase the practical ability of those other creditors to negotiate an advantageous settlement.[129] This aspect of bankruptcy remoteness can be achieved by prohibiting the SPV, in its organizational documents, from incurring any debt or other obligations other than specifically under its bonds.[130] This means that the SPV—subject to the exception described below for risk securitization[131]—will not engage in any business other than issuing those bonds and investing the proceeds.[132] That is why the SPV is a "special purpose" vehicle.[133]

Unlike SPVs used in traditional securitization transactions, an SPV used for risk securitization indemnifies the insurer in the event the covered event (e.g., a pandemic) occurs.[134] This indemnification obligation, if triggered, would undermine the SPV's bankruptcy remoteness by paying out cash that the SPV otherwise would have available to pay its bonds as they come due. Investors in CAT bonds implicitly accept this exception to bankruptcy remoteness because it drives their diversification and high rate of return.[135] Rating agencies recognize this exception by giving relatively lower credit ratings to CAT bonds.[136]

To prevent the SPV from defaulting on repaying its bonds, it also is critical to control so-called maturity transformation—the risk of an asset-

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125.   *See id.*

126.   *See* Involuntary Cases, 11 U.S.C. § 303. *See also* SCHWARCZ, *supra* note 21, at § 3-21. An SPV also could be forced into involuntary bankruptcy in the unlikely event that a custodian is appointed to take control of substantially all of the SPV's assets. *Id.*

127.   *See* 11 U.S.C. § 303.

128.   *Cf. supra* note 118 and accompanying text. *But cf. infra* notes 137–142 and accompanying text (discussing how the maturity transformation risk could cause defaults on the SPV's bonds).

129.   *Cf.* SCHWARCZ, *supra* note 21, at §§ 2:2.1, 3:2.1 (discussing how other creditors of the Days Inn Receivables Funding SPV were able to so negotiate an advantageous settlement).

130.   *Id.* at § 3:3.

131.   *See infra* notes 134–136 and accompanying text.

132.   *See* SCHWARCZ, *supra* note 21, at § 3:3.

133.   *Cf. id.* (discussing what it means for an SPV to be a special purpose vehicle).

134.   *See supra* notes 42–43 and accompanying text.

135.   *See supra* notes 30–32 and accompanying text.

136.   *Cf. infra* note 165 and accompanying text (observing that no issue of catastrophe bonds has been rated investment grade in over ten years).

liability mismatch that results from the short-term funding of long-term projects.[137] This mismatch creates a "liquidity default risk" that borrowers will be unable to repay their lenders—a risk that was at the core of the global financial crisis.[138] Normally, SPVs control maturity transformation by monitoring and trying to allocate collections to pay maturing obligations (such as principal and interest coming due on bonds or other debt securities issued by the SPV)[139] and also by contracting, for a fee,[140] to obtain short-term bank loans as needed to cover any asset-liability mismatch.[141] Risk-securitization transactions, however, arguably have a lower maturity transformation risk than traditional securitization. By investing in liquid and highly rated debt securities,[142] the SPV in a risk-securitization transaction should be able more precisely to allocate collections to pay its maturing obligations, thereby reducing the risk of an asset-liability mismatch. That could preclude the SPV's need to contract to obtain short-term bank loans, thereby avoiding that cost.[143]

An SPV also can become subject to bankruptcy by being substantively consolidated into the bankruptcy estate of an affiliate.[144] Substantive consolidation is an equitable doctrine that, in the context of this Article, allows a bankruptcy court, under certain conditions, to consolidate the assets and liabilities of the SPV and a bankrupt affiliate.[145] Although federal circuit

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137. *See, e.g.*, Huberto M. Ennis & Todd Keister, *Bank Runs and Institutions: The Perils of Intervention*, 99 AM. ECON. REV. 1588, 1590 (2009) ("Money market funds and other arrangements perform maturity transformation by investing in long-term assets while offering investors the ability to withdraw funds on demand.").

138. *See, e.g.*, Andrew Metrick & Gary Gorton, *Regulating the Shadow Banking System*, *in* BROOKINGS PAPERS ON ECONOMIC ACTIVITY 261 (2010), https://www.brookings.edu/bpea-articles/regulating-the-shadow-banking-system-with-comments-and-discussion/ [https://perma.cc/W4XJ-AUZ6]; Daniel Covitz, Nellie Liang & Gustavo A. Suarez, *The Evolution of a Financial Crisis: Panic in the Asset-Backed Commercial Paper Market* 1 (Fed. Rsrv. Bd. Fin. & Discussion Series, Working Paper No. 2009-36, 2009), https://www.federalreserve.gov/pubs/feds/2009/200936/200936pap.pdf [https://perma.cc/4Z2U-3EEG] (arguing that maturity transformation "played a central role in transforming concerns about the credit quality of mortgage-related assets into a global financial crisis"); Viral V. Acharya & S. Viswanathan, *Leverage, Moral Hazard, and Liquidity*, 66 J. FIN. 99, 103 (2011) (observing that short-term funding of long-term projects "played an important role in the financial crisis of 2007 to 2009 and the period preceding it").

139. *See Conduits: Their Structure and Risk*, MORGAN STEARNS, http://www.morganstearns.com/securitization-2b-2 [https://perma.cc/Z7ZT-X7SY].

140. *See* SCHWARCZ, *supra* note 21, § 6.1 (discussing the fee that banks charge for committing to extend liquidity facilities).

141. *See Rating Action: Moody's ABCP Rating Actions for the Seven Day Period Ended March 14, 2002*, MOODY'S (Mar. 15, 2002), https://www.moodys.com/research/MOODYS-ABCP-RATING-ACTIONS-FOR-THE-SEVEN-DAY-PERIOD-ENDED--PR_65816 [https://perma.cc/3GPL-T6CX].

142. *Cf. supra* note 40 and accompanying text (observing that CAT bond-issuing SPVs usually invest in liquid and highly rated debt securities).

143. *See supra* note 140 and accompanying text (referencing the liquidity-lending commitment fee).

144. *See supra* note 121 and accompanying text.

145. *See* SCHWARCZ, *supra* note 21, at § 3:4.

courts are split on when substantive consolidation should be allowed, a threshold requirement is that there be a breakdown of corporate formalities between the firms being considered for substantive consolidation.[146] To protect its investors, an SPV therefore should be structured to maintain all corporate formalities between that entity and its affiliates.[147] Ironically, if the only affiliates of an SPV used in a risk-securitization transaction are insurance companies, it might even be easier to protect the SPV against substantive consolidation because insurance companies are not themselves subject to federal bankruptcy law.[148]

2. Issuing the PCAT bonds in compliance with applicable laws

In the United States, the Securities Act of 1933 and Securities Exchange Act of 1934 impose regulations and restrictions that are relevant to the issuance of securities—in this Article's example, the PCAT bonds—by the SPV.[149] The 1933 Act imposes disclosure requirements and requires the filing of registration statements with the Securities and Exchange Commission (SEC) in connection with any public offering of a nonexempt security.[150] A public offering would have the advantage of the PCAT bonds being freely traded, and therefore the bonds could be purchased by a wider array of investors than in a private placement.[151] A public offering also would provide fully transparent and publicly available disclosures. However, such offerings can take months to implement and carry significant registration costs.[152]

To facilitate their issuance and reduce transaction costs, most CAT bonds to date have been issued under the SEC Rule 144A exemption from the 1933 Act disclosure and registration.[153] Although Rule 144A limits eligible investors to defined qualified institutional buyers (QIBs), which include

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146. *See id.* at § 3:4:1. If there is such a breakdown of corporate formalities, courts in the Second and Third Federal Judicial Circuits disallow a substantive consolidation that harms good-faith creditors, whereas courts outside those Circuits tend to balance whether the overall benefit of allowing substantive consolidation substantially outweighs its harm. *Id.*

147. *Id.*

148. *See* 11 U.S.C. § 109(b)(2), (b)(3)(A). Because insurance insolvency law is highly specialized and varies from state to state, Peter G. Gallanis, *Insurance Law*, ABA (Apr. 2, 2019), this Article does not purport to examine whether any state's insurance insolvency law includes equitable doctrines similar to substantive consolidation. Parties structuring actual risk securitization transactions should make that examination under any insurance insolvency law applicable to the SPV's affiliates.

149. *See* SCHWARCZ, *supra* note 21, at § 6:2.

150. *See id.* at § 6:2.

151. *See id.* at § 6:2.1.

152. *See id.*

153. *See Insurance Linked Securities*, FINRA (July 9, 2021), https://www.finra.org/investors/alerts/catastrophe-bonds-and-other-event-linked-securities [https://perma.cc/S789-R8JJ].

only large and sophisticated firms,[154] most parties interested in investing in securitization transactions tend to be QIBs.[155] A potential policy drawback to issuing CAT bonds under that exemption, however, is that Rule 144A disclosures neither are generally available to the public nor require the full range of information that must be disclosed in a public offering.[156] Some argue that CAT bonds should be publicly issued and traded in order to create more transparency and encourage a wider investor base.[157]

Additionally the Investment Company Act of 1940, subject to exemptions, requires that any entity primarily engaged in owning or holding securities must register with the SEC as an investment company.[158] Such registration is usually very costly due to the extensiveness of the Act's regulatory scheme.[159] As a result, transactions are typically structured to qualify for an exemption.[160] For example, SEC Rule 3a-7 provides an exemption for SPVs that meet four criteria:[161] the SPV must issue a fixed-income security or other "eligible asset,"[162] that is investment grade, acquired for a primary purpose other than recognizing gains or decreasing losses from market changes, with a trustee appointed by the issuer who takes reasonable steps to take a perfected security interest and to ensure that that cash flows from the issuer's assets make it into a segregated account.[163] Because the primary purpose of a PCAT bond-issuing SPV is other than profiting off market-value fluctuations, and the SPV is issuing a fixed-income security (the PCAT bond[164]) for which it easily could appoint a trustee, such an SPV should be able to qualify for the Rule 3a-7 exemption if the PCAT bonds are rated investment grade.

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154. With limited exceptions, QIBs include only firms that own and invest at least $100 million in securities of non-affiliated issuers. *See* 17 C.F.R. § 230.144A (2021).

155. *See* SCOTT BAUGUESS, RACHITA GULLAPALLI & VLADIMIR IVANOV, CAPITAL RAISING IN THE U.S.: AN ANALYSIS OF THE MARKET FOR UNREGISTERED SECURITIES OFFERINGS, 2009-2014, at 7 (2015).

156. *See* DORSEY, RULE 144A EXPLAINED 1 (Apr. 2020), https://www.dorsey.com/~/media/files/uploads/images/cameron_rule_144_-explained_april_2020.pdf [https://perma.cc/TR6Z-5KQL]. The SEC has no specific requirements as to what information is provided to QIBs in Rule 144A-exempt offerings. Instead, disclosure practices are set by industry standards and a desire to avoid liability to investors under federal antifraud law. *See id.*

157. *See infra* note 372 and accompanying text.

158. *See* SCHWARCZ, *supra* note 21, at § 6:1.1.

159. *See id.*

160. *See id.*

161. *See id.* at § 6:1.3.

162. "[E]ligible assets" are "financial assets . . . that by their terms convert into cash within a finite time period." *Exclusion From the Definition of Investment Company for Structured Financings*, 57 Fed. Reg. 56,248 (Nov. 27, 1992) (codified at 17 C.F.R. pt. 270).

163. Howard S. Altarescu & Mark M. Racic, *ABS Issuers and the Rule 3a-7 Exclusion from the Investment Company Act*, ORRICK 2, Sept. 2011, at 2.

164. *See infra* note 296 (noting that bonds are the most common type of fixed-income security).

Because the SPV's indemnification obligation, if triggered, would pay out cash that the SPV otherwise would have available to pay its bonds as they come due, no issue of catastrophe bonds has been rated investment grade in over ten years, however.[165] Nonetheless, in the case of PCAT bonds, an investment grade rating may be more feasible if, as this Article (among others) proposes, the government bears at least some portion of the pandemic-related risk.[166] Non-pandemic CAT bonds lack any government risk-sharing.[167] Furthermore, although the investment-grade-securities requirement for a Rule 3a-7 exemption would apply to a public offering, it would not apply to sales of securities to QIBs.[168] As discussed, most CAT bonds to date have been sold to QIBs.[169]

3. *Obtaining credit ratings for the PCAT bonds*

Bonds and other debt securities typically are rated by so-called rating agencies, such as Moody's Investors Service, Inc. and Standard & Poor's Ratings Group.[170] Rating agencies are private companies whose business is assessing the risks associated with the full and timely payment of the rated securities.[171] The significance of the rating depends entirely on the reputation among investors of the particular rating agency. Long- and short-term debt have separate rating scales, generally reflecting the different risks associated with long and short-term investing. The highest rating on long-term debt securities is typically AAA, with ratings descending to AA, then to A, and then to BBB and below.[172] The higher the rating, the lower the

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165. *See Investment Grade Catastrophe Bond Unique for ILS Market*, FITCHRATINGS (Jan. 31, 2020, 10:56 AM), https://www.fitchratings.com/research/insurance/investment-grade-catastrophe-bond-unique-for-ils-market-31-01-2020 [https://perma.cc/WHY6-3EUP]. For example, Moody's rated the Muteki Ltd. earthquake CAT bonds as Ba2, which is less than investment grade. *See supra* note 75 and accompanying text. Some other offshore CAT bond issuances are unrated.

166. *See infra* notes 306–342 and accompanying text.

167. *See infra* notes 293–318 and accompanying text.

168. *See* 17 C.F.R. § 270.3a-7 (a)(2)(ii) (2020). *See also* Stuart N. Goldstein, Michael Gambro, Maurine Bartlett & Gregg Jubin, *Asset-Backed Securities Issuers (ICA Rule 3a-7)*, CADWALADERCABINET, https://www.findknowdo.com/content/abs-issuers-%28ica-rule-3a-7%29 [https://perma.cc/33VH-X83X].

169. *See supra* notes 153–155 and accompanying text. Even if a Rule 3a-7 exemption from the 1940 Act were unavailable, there are other possible exemptions. For example, section 3(c)(7) of the 1940 Act partially exempts private issuances exclusively to qualified purchasers, as defined by that Act. SCHWARCZ, *supra* note 21, at § 6:1.2. Sections 3(b)(2) and 6(c) of the 1940 Act also would allow an SPV to solicit the SEC directly to obtain an exemption from registration because either (a) the SPV is engaged in a business other than that of investing and trading securities or (b) an exemption is in the public interest. *Id.*

170. For a more detailed discussion of rating agencies, see generally Steven L. Schwarcz, *Private Ordering of Public Markets: The Rating Agency Paradox*, 2002 U. ILL. L. REV. 1.

171. *Id.* at 3.

172. *Id.* at 7. Long-term ratings also sometimes have "+" and "-" designations associated with the ratings.

rating agency has assessed the risk associated with the securities in question.[173] "Ratings below BBB- are deemed non-investment grade, and indicate that full and timely repayment on the securities may be speculative."[174]

Because a high rating signals low risk to investors, an SPV that issues AAA rated securities can more easily attract investors in its securities than can an SPV that issues AA, A, or BBB rated securities. "Therefore, the [SPV] with AAA rated securities can pay a lower interest rate on those securities, and still attract investors, than can the [SPV] with the lower rated securities."[175] If they find the extra risk acceptable, some investors may prefer to invest in BBB-rated securities rather than AAA-rated securities "in order to benefit from the higher interest rate."[176] The rating addresses only the safety, and not the economic desirability to the investor, of the investment.[177]

In rating PCAT bonds, rating agencies will identify and evaluate the risks that could result in losses to investors.[178] In general, the risks to CAT bond investors include (a) the covered peril(s); (b) counterparty risk; (c) collateral risk; and (d) documentation and legal risk.[179] The primary risk is the covered peril, which, in this Article's context, is a covered pandemic.

Other than pandemic risk, the aforesaid risks are likely to be low. Counterparty risk refers, in this Article's context, to the indemnified insurer failing to pay its premiums to the SPV when due.[180] Rating agencies themselves treat that risk as low.[181] Collateral risk refers to the risk that the SPV's investments will lose value.[182] This risk also should be low because the SPV invests in "liquid and highly-rated debt securities, including U.S.

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173. A rating usually is assigned to a particular issuance of a company's securities, and not necessarily to the company itself, because a company could issue different securities having different risk characteristics. Indeed, rating agencies view their ratings as worldwide standards, and not as relative risk standards within countries. Thus, a BBB rating on securities is intended to convey the same level of risk irrespective of the jurisdiction in which the securities are issued. *See id.* at 8.

174. *Id.* at 7 (internal quotations omitted) (quoting Steven L. Schwarcz, *The Universal Language of Cross-Border Finance*, 8 DUKE J. COMPAR. & INT'L L. 235, 253). The term investment grade "was originally used by various regulatory bodies to connote obligations eligible for investment by institutions such as banks, insurance companies and savings and loan associations. Over time, this term gained widespread acceptance throughout the investment community." STANDARD & POOR'S, CORPORATE RATINGS CRITERIA 9 (1998).

175. Schwarcz, *supra* note 170, at 8.

176. *Id.*

177. *See id.* at 6.

178. *See* CATASTROPHE BONDS, *supra* note 101, at 3.

179. *See id.*

180. *See id.*

181. *Cf. id.* at 9 ("Typically, counterparty risk is small . . . .").

182. *See id.* at 9.

Treasury money-market instruments."[183] Documentation and legal risk refers to risks associated with the SPV's special purpose organization and bankruptcy remoteness.[184] Because those risks are "generally consistent with [similar risks] . . . in all areas of structured finance,"[185] this Article also will assume these risks are low.

In contrast, the primary risk—that of a covered pandemic occurring—may not be low. In their assessment, rating agencies are likely to take into account the uncertainty of models that purport to quantify that risk.[186] Notwithstanding claims that certain firms can quantify pandemic risk,[187] pandemic risk is a "tail event," so that even if quantifications "match the historical record perfectly," that would "still provide an inadequate description of the tail of the loss distribution."[188] Rating agencies may compensate for this uncertainty "either by stressing the relevant parameters or by directly incorporating uncertainty into [their] analysis."[189]

The actual credit rating that rating agencies assign to PCAT bonds is beyond the scope of this Article. Other things being equal, however, they should assign higher ratings to senior tranches of PCAT bonds than to subordinated tranches because the former are less risky,[190] and they should assign higher ratings to PCAT bonds to the extent the government shares risk on a first-loss or *pari passu* basis rather than on a second-loss basis.[191]

4. Implementing a senior-subordinate structure to provide credit enhancement

As discussed above, different investors have different risk tolerances. Some would prefer to take higher risk and earn a higher rate of return, whereas others, who are more risk-averse, would prefer to take lower risk notwithstanding receiving a lower rate of return.[192] Securitization

183.   This risk should be low because the SPV invests in "highly rated eligible investments," *see* CATASTROPHE BONDS, *supra* note 101, at 3, such as liquid and highly-rated debt securities, including U.S. treasury money-market instruments. Lorilee A. Medders and Steven L. Schwarcz, Risk Securitization and Insurance (July 30, 2021) (manuscript at *8 n.20).

184.   *See* CATASTROPHE BONDS, *supra* note 101, at 8.

185.   *Id.* at 9.

186.   *Cf. id.* at 7 ("A particularly important aspect of the modeling process is the treatment of uncertainty. Since no one can perfectly model natural phenomena, and the data that modeling firms use to develop these models are limited and generally imperfect, we must identify the sources and assess the level of uncertainty.").

187.   *See supra* note 14 and accompanying text.

188.   CATASTROPHE BONDS, *supra* note 101, at 7.

189.   *Id.*

190.   *See infra* notes 192–205 and accompanying text.

191.   *See infra* Section III.C.

192.   *See Risk Aversion of Investors and Portfolio Selection*, FIN. TRAIN, https://financetrain.com/risk-aversion-of-investors-and-portfolio-selection/ [https://perma.cc/6HEE-FF8F].

transactions often utilize so-called credit enhancement to lower the risk for such risk-averse investors.[193] Senior-subordinate structures provide an important method of credit enhancement.[194]

To create a senior-subordinate structure to credit enhance PCAT bonds, the SPV would issue two or more classes of PCAT bonds, with any reduction of the SPV's assets being absorbed by the different classes in sequence—with the most senior-priority bonds being paid first out of the remaining assets, and the most subordinated-priority (sometimes referred to as "junior") bonds being paid last.[195] The goal of this structure is to protect payment of—by effectively overcollateralizing—the senior PCAT bonds.[196]

For example, consider an SPV with $1,000 of assets and $900 of PCAT bonds consisting of $700 of senior bonds and $200 of subordinated bonds. If the SPV is required to pay $150 of the assets to indemnify the insurer for pandemic-related payments, the remaining $850 of assets would be available to repay the $700 senior bonds in full, leaving only $150 (*i.e.*, $850 minus $700) to pay the subordinated bonds (ignoring the time value of money). Investors in the subordinated bonds would thus be paid only 75 cents on the dollar (*i.e.*, $150 on their $200 of claims), whereas investors in the senior bonds would be paid in full.[197]

Although SPVs issuing CAT bonds sometimes use senior-subordinate structures to provide credit enhancement, they tend to refer to them using insurance industry terminology for allocating insurer risk, typically by assigning different "attachment" and "exhaustion" points.[198] Assume, for example, that an SPV issues two classes of bonds to allocate the insurance risk among bondholders, enabling bonds of the less risky class to obtain a

193. *See* Adam M. Tempkin & Scott Mason, STANDARD & POOR'S, CREDIT FAQ: THE BASICS OF CREDIT ENHANCEMENT IN SECURITIZATIONS (2008), https://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2008-06-24%20S&P%20Basics%20of%20Credit%20Enhancement%20in%20Securitizations.pdf.

194. *Cf.* DELOITTE, SECURITIZATION STRUCTURED FINANCE SOLUTIONS (2018), https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/financial-services/lu_securitization-finance-solutions.pdf [hereinafter DELOITTE] (referencing the senior-subordinate structure throughout); Steven L. Schwarcz, *Regulating Financial Guarantors*, 11 HARV. BUS. L. REV. 159, 170–71 (2021) (discussing senior-subordinate structures in securitization transactions).

195. *See* Steven L. Schwarcz, *Regulating Complexity in Financial Markets*, 87 WASH. U. L. REV. 211, 220 n.46 (2009).

196. *Id. Cf.* Joshua Coval, Jakub Jurek & Erik Stafford, *The Economics of Structured Finance*, 23 J. ECON. PERSPVS. 3, 6 (2009) ("The degree of protection offered by the junior claims, or overcollateralization, plays a crucial role in determining the credit rating for a more senior tranche, because it determines the largest portfolio loss that can be sustained before the senior claim is impaired.").

197. *Cf.* Adam J. Levitin & Susan M. Wachter, *Explaining the Housing Bubble*, 100 GEO. L.J., 1177, 1237–38 (2012) (explaining the senior-subordinated structure).

198. *See, e.g.*, *Citrus Re. Ltd. (Series 2015-1)*, ARTEMIS, https://www.artemis.bm/deal-directory/citrus-re-ltd-series-2015-1/ [https://perma.cc/BEY6-M4AN] (using those terms to discuss insurer risk allocation in the Citrus Re transaction and calling it a "reinsurance tower").

higher credit rating than would otherwise be achieved by issuing a single class of bonds.[199] If and when a triggering event occurs, requiring an insurance-indemnification payout,[200] the money used by the SPV to make that payout will first be drawn from the funds allocated to repay the more subordinate class of bonds.[201] That first loss is the attachment point of those bonds.[202] The SPV will continue to make payouts from the funds allocated to repay the more subordinate class of bonds until those funds are exhausted, and thus there is no money left to repay those bonds.[203] That is the exhaustion point for those bonds.[204] Any money thereafter used by the SPV to make insurance-indemnification payouts necessarily will be drawn from the funds allocated to repay the more senior class of bonds—and that is that class's attachment point.[205]

Thus, if an SPV issues $500,000 of Class B (i.e., more subordinated) CAT bonds and $500,000 of Class A (i.e., more senior) CAT bonds, the Class B CAT bonds would have an attachment point of $1 and an exhaustion point of $500,000, and the Class A CAT bonds would have an attachment point of $501,000 and an exhaustion point of $1,000,000. Regardless of the attachment point/exhaustion point terminology, this first-loss, second-loss structure is functionally identical to the standard senior-subordinate structure used to provide credit enhancement.

Sections B, C, and D next discuss even more novel legal challenges of risk securitization.

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199. *See* Joshua D. Coval, Jakub W. Jurek & Erik Stafford, *Economic Catastrophe Bonds* 6 (Harv. Bus. Sch. Working Paper No. 102, 2007).

200. *Cf. supra* note 98 and accompanying text (describing a CAT bond triggering event). CAT bonds can carry different types of triggers such as an indemnity loss, industry loss, or parametric loss. *See* RISK MGMT. SOLS., CAT BONDS DEMYSTIFIED: RMS GUIDE TO THE ASSET CLASS 4 (2012), https://forms2.rms.com/rs/729-DJX-565/images/cm_cat_bonds_demystified.pdfhttps:// [perma.cc/SJR9-W545].

201. *See* *ILS Glossary*, CREDIT SUISSE, https://www.credit-suisse.com/us/en/asset-management/insurance-linked-strategies/ils-glossary.html?t=632_0.3140478277251174 [https://perma.cc/8ZPD-2YSM]; Schwarcz, *Regulating Financial Guarantors*, *supra* note 194, at 171.]

202. *See id.* Attachment points are liability caps for an insurer "to protect itself against too many unexpected losses." Julia Kagan, *Aggregate Stop-Loss Reinsurance*, INVESTOPEDIA (July 31, 2021), https://www.investopedia.com/terms/a/aggregate-stoploss-reinsurance.asp [https://perma.cc/JY7T-NA5D].

203. *See* DELOITTE, *supra* note 197, at 17 ("The subordinated tranche notes are intended to absorb losses from the collateral pool prior to more senior note classes. . . . In the event of default on a collateral loan, the loan amount would be deducted from the balance of the subordinated tranche notes/classes.").

204. *See id.* (defining "Exhaustion Point").

205. *See id.* at 28.

B. Regulating SPVs as Reinsurers

Recall that by indemnifying the insurer, the SPV effectively is providing reinsurance.[206] Insurers rely extensively on reinsurance to mitigate their catastrophe risk.[207] Although governments regulate both insurers and reinsurers, the purposes of that regulation are different. The purpose of regulating primary insurers is to protect policyholders, whereas the purpose of regulating reinsurers is to assure their solvency—and thus their ability to reimburse payments made by the primary insurer.[208]

By effectively providing reinsurance, SPVs used in risk-securitization transactions should, in principle, be regulated as reinsurers. Because their purpose would be to reimburse payments made by the primary pandemic-risk insurers,[209] such SPVs must stay solvent in order to provide that reimbursement. These views would appear to be generally supported by the National Association of Insurance Commissioners (NAIC), which accredits state insurance departments as having met baseline standards of solvency regulation[210] and whose members include the chief insurance regulators from each U.S. state.[211] In a related but narrower context,[212] the NAIC has recommended that regulators assess and monitor the risks that SPVs may pose,[213] especially when used in transactions involving insurers.[214] The NAIC has not yet taken a stand, however, on SPVs used in risk-securitization transactions.

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206. *See supra* note 41 and accompanying text. Even if the SPV reinsures a reinsurer (retrocession) or a government catastrophe fund, it should not change this subpart's analysis. *Id.*; Jodie L. Stauffer, *What Does Retrocession Mean?*, INSURANCEOPEDIA, (Apr. 6, 2021), https://www.insuranceopedia.com/definition/3970/retrocession [https://perma.cc/Q33K-K9YU].

207. *See* AM. ACAD. ACTUARIES CATASTROPHE MGMT. WORK GRP., CATASTROPHE EXPOSURE AND INSURANCE INDUSTRY CATASTROPHE MANAGEMENT PRACTICES, 15 (2001); Dwight M. Jaffee & Thomas Russell, *Catastrophe Insurance, Capital Markets, and Uninsurable Risks*, 64 J. RISK & INS. 205, 217 (1997).

208. *See* U.S. GOV'T ACCOUNTABILITY OFF., GAO-90-82, INSURANCE REGULATION – STATE REINSURANCE OVERSIGHT BUT PROBLEMS REMAIN 4 (1990).

209. *See supra* notes 42–43 and accompanying text.

210. *See*   *Accreditation*,   NAIC   (Apr.   20,   2021), https://content.naic.org/cipr_topics/topic_accreditation.htm [https://perma.cc/JM6X-TTRU]. *Cf. The NAIC   Accreditation   Program,*   NAIC   (Nov.   2019), https://content.naic.org/sites/default/files/government-affairs-brief-accreditation-program.pdf [https://perma.cc/38JC-D8TE] ("The Accreditation Program provides the impetus for states to adopt in a consistent manner the NAIC model laws, regulations and requirements that make up the U.S. insurance financial solvency framework.").

211. *See Our Story*, NAIC, https://content.naic.org/about [https://perma.cc/4ZSE-YPMQ].

212. That context is insurers using captive offshore SPVs as reinsurers for the purpose of subverting regulation imposing domestic reserve requirements. *See generally* NAT'L ASS'N INS. COMM'RS, CAPTIVES AND SPECIAL PURPOSE VEHICLES (2013).

213. *See id.* at 22.

214. *See id.*

If SPVs used in risk-securitization transactions were regulated as reinsurers, they generally would be required to be licensed or accredited in their state of domicile.[215] They might be subject to minimum capital and surplus reserve requirements based on the amount and type of reinsurance being provided.[216] They also might need to comply with regulatory examinations, officer-and-director qualification requirements, and various other transaction restrictions mandated by the regulatory body.[217]

Regulation could help to assure, but could not absolutely guarantee, the ability of SPVs to reimburse payments made by the primary pandemic-risk insurers. The failure of the highly regulated monoline insurance industry provides a cautionary tale. Monoline insurers, like SPVs used in risk-securitization transactions, provided a fundamentally new insurance product: guarantees of payments due on mortgage-backed securities and other bonds issued in securitization transactions.[218] That newly insured risk, like pandemic risk, was much less certain than the statistically predictable consumer risks covered by traditional insurance and reinsurance.[219] Notwithstanding the regulation of the monoline industry,[220] the 2008 collapse of the mortgage-backed securities market caused all but two monoline insurers, Assured Guaranty and BHAC, to fail.[221]

A final question is which jurisdictions should regulate SPVs as reinsurers, to assure their solvency. Although U.S. domestic reinsurers are regulated by the state in which they are domiciled,[222] certain states including New York and California also regulate reinsurers that do business and sell policies in their state.[223] Most monoline insurers, for example, have been

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215. Marion Leydier, Mark F. Rosenberg & William D. Torchiana, *Q&A: Insurance & Reinsurance Regulation in USA*, Lexology (June 29, 2020), https://www.lexology.com/library/detail.aspx?g=9c4f572f-36af-4fc8-b3c8-a5a4dffa9deb [https://perma.cc/5PDA-YHV3] ("[I]nsurance business (including reinsurance) is primarily regulated at the state level.").

216. *See id.*

217. *See id.* The cost of complying with these regulations might make a risk securitization economically less feasible.

218. *See* J.M. Pimbley, *Bond Insurers*, 22 J. Applied Fin. 1, 1 (2012).

219. *Cf. infra* note 285 and accompanying text (comparing pandemic risk to traditional insurance risk).

220. Most if not all monoline insurers were regulated by the New York State Department of Insurance. *See* D. Dulani Jayasuriya, *The Rise and Fall of the Monoline/Bond Insurers: Icarus of the 21st Century*, NBMC 640, 643 (2016), https://nbmconference.files.wordpress.com/2017/03/648-665.pdf [https://perma.cc/QJ6Y-NWZ8]. *See also infra* note 224 and accompanying text.

221. *See* Tima Tilek-uulu Moldogaziev, *The Collapse of the Municipal Bond Insurance Market: How Did We Get Here and is There Life for the Monoline Industry Beyond the Great Recession?*, 25 (1) J. Pub. Budgeting, Acct. & Fin. Mgmt. 199, 200 (2013).

222. *See* John S. Pruitt, *Insurance and Reinsurance in the United States: Overview*, Thomson Reuters Prac. L., https://uk.practicallaw.thomsonreuters.com/9-501-3187?transitionType=Default&contextData=(sc.Default)&firstPage=true [https://perma.cc/88AZ-QNGF].

223. *See* The Insurance and Reinsurance Law Review 439 (Peter Rogan ed., 3d ed. 2015).

regulated by the New York State Department of Insurance because they have conducted their operations in that state.[224] Similarly, most SPVs would be likely to issue their PCAT bonds in New York, or at least under New York law-governed transactions, because bondholders view New York law as providing the most commercial certainty to their investments.[225] Hence, those SPVs would likely be regulated by the New York State Department of Insurance since they are doing business there.

In practice, however, some SPVs might be organized outside the United States, given the reality that reinsurance today is an international business.[226] Foreign reinsurers, which in many cases are licensed and supervised overseas, provide a substantial portion of U.S. domestic reinsurance.[227] This multi-jurisdictional international regulation could create a lack of uniformity.[228] More significantly, it might foster regulatory opacity, making it difficult to monitor whether SPVs acting as reinsurers are in fact adequately regulated.[229] To facilitate monitoring and help ensure

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224. *See* Pimbley, *supra* note 218, at 4. Article 69 of New York's Insurance Law regulates "financial guaranty insurance," defined in relevant part as "an indemnity contract . . . under which loss is payable, upon, proof of occurrence of financial loss, to an insured claimant, obligee or indemnitee . . . ." N.Y. INS. LAW § 6901.

225. *See* Diane Lourdes Dick, *Confronting the Certainty Imperative in Corporate Finance Jurisprudence*, 2011 UTAH L. REV. 1461, 1494 (2011) (noting New York courts' continuing effort to protect party expectations and certainty); *Cf.* Larry Schiffer, *Reinsurance and Ever-Expanding Regulation and Oversight*, INT'L RISK MGMT. INST. (Sept. 2013), https://www.irmi.com/articles/expert-commentary/reinsurance-and-ever-expanding-regulation-and-oversight [https://perma.cc/MFX2-L75H]; *Reinsurance*, NAT'L ASS'N INS. COMM'RS (June 11, 2021), https://content.naic.org/cipr_topics/topic_reinsurance.htm [https://perma.cc/2TRT-BFFG].

226. Ari Chester, Sylvain Johansson, Erwann Michel-Kerjan, Oleksiy Rachok & Mei Dong, *Global Reinsurance: Fit for the Future?*, MCKINSEY & CO., (Sep. 26, 2017), https://www.mckinsey.com/industries/financial-services/our-insights/global-reinsurance-fit-for-the-future [https://perma.cc/ZKW3-4RKP]; *Cf.* Schwarcz & Schwarcz, *supra* note 15, at 1615–16. In many CAT bond transactions, the SPV appears to be an offshore-domiciled entity (e.g., in Bermuda or the Cayman Islands). *See* Robert Klein & Shaun Wang, *Catastrophe Risk Financing in the United States and the European Union: A Comparative Analysis of Alternative Regulatory Approaches*, 76 J. RISK & INS. 607, 622–23 (2009). *Cf. Citrus Re Ltd.*, *supra* note 61 (noting that Citrus Re Ltd. is organized under Bermuda law). In the author's experience, however, at least U.S. investors tend to prefer bonds issued by U.S.-domiciled SPVs. Furthermore, rating agencies might limit the rating of PCAT bonds issued by a foreign-domiciled SPV to the foreign jurisdiction's sovereign-debt rating (the so-called sovereign rating ceiling). *See* Heitor Almeida, Igor Cunha, Miguel A. Ferreira & Felipe Restrepo, *The Real Effects of Credit Ratings: The Sovereign Ceiling Channel*, 47 CFA INST. 9 (Sept. 2017).

227. FED. INS. OFF., DEP'T OF THE TREASURY, THE BREADTH AND SCOPE OF THE GLOBAL REINSURANCE MARKET AND THE CRITICAL ROLE SUCH MARKET PLAYS IN SUPPORTING INSURANCE IN THE UNITED STATES 18 (Dec. 2014).

228. *See id.* at 20. *Cf.* Marie-Louise Rossi & Nicholas Lowe, *Regulating Reinsurance in the Global Market*, 27 GENEVA PAPERS ON RISK & INS. 122, 127–29 (2002) (arguing that the reinsurance industry would benefit from more cohesive standards).

229. *See* Schwarcz & Schwarcz, *supra* note 15, at 1616–18. *Cf.* GRP. OF THIRTY, REINSURANCE AND INTERNATIONAL MARKETS 6, 13 (2006) ("The risk information published by reinsurers varies significantly across firms in both frequency and scope" resulting in a "widespread perception that publicly-available information about both the financial state and the risk profile of reinsurance companies is in many cases inadequate.").

SPV solvency, any government requirement that businesses purchase pandemic insurance should include a requirement about where the underlying risk-securitization transactions should be conducted.[230]

C. *Enforcing Government Insurance Mandates*

There also could be legal challenges to any government requirement that businesses purchase pandemic insurance.[231] In concept, such a requirement would resemble the individual mandate of the Affordable Care Act (ACA). That mandate requires individuals either to purchase health insurance or to opt out by paying a penalty in the form of a tax.[232]

In addressing the constitutionality of the individual mandate, the U.S. Supreme Court reasoned that the Commerce Clause of the Constitution allows Congress only to regulate actions of those participating in a market, not the inactions of those choosing not to participate in the market.[233] The Court rejected the Government's temporal argument—that because sickness and injury are inevitable, the uninsured will, at some point, become active in the healthcare market[234]—holding that Commerce Clause precedent does not permit Congress to regulate present conduct on the basis of "prophesied future activity."[235]

Nonetheless, the individual mandate was able to survive under Congress's power to tax.[236] Designed to incentivize the purchase of health insurance, the individual mandate constituted a tax to promote certain behaviour, not unlike a tax on cigarettes to reduce the use of nicotine. The Court reaffirmed that Congress can achieve regulatory goals via its taxing power, so long as the mandated payment functions as a "tax," turns on "practical characteristics," and should dampen or deter the behaviour in question.[237] The Court found that the individual mandate satisfied these requirements because the opt-out payment was determined by an

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230. Although this Article focuses on SPV indemnification as a means to diversify risk to the capital markets to enable insurers to issue pandemic insurance, insurers also may want that indemnification to provide the financial statement credit that insurers normally receive from reinsurance. Traditionally, domestic insurance regulators have allowed insurers to satisfy collateral requirements through the use of reinsurers. *See* THE INSURANCE AND REINSURANCE LAW REVIEW, *supra* note 223, at 435.

231. This discussion also benefited from the valued research of Leila Hatem, Duke Law Class of 2021.

232. *See* Nat'l Fed'n of Indep. Bus. v. Sebelius, 567 U.S. 519, 539 (2012) (summarizing the individual mandate of the Affordable Care Act).

233. *See id.* at 520–21.

234. *See id.* at 555–57.

235. *Id.*

236. *See id.* at 575 (holding that the federal government has the power to impose a tax on the uninsured).

237. *See id.* at 573.

individual's income level and, like a tax, was paid into the U.S. Treasury.[238] Furthermore, despite being called a penalty, the Court found that the mandate's opt-out payment was not technically a penalty because it did not punish an illegal action and was generally less expensive than actually getting healthcare insurance.[239] Importantly, the Court found it acceptable that the mandate was "plainly designed to expand health insurance coverage."[240]

A federal mandate requiring businesses to purchase adequate pandemic insurance, tailored to the business's income level, or to make an opt-out payment to the U.S. Treasury should similarly be likely to be construed as a tax and thus survive a constitutional challenge. Any opt-out payments could ultimately be used by the government to create a pandemic catastrophe fund or even to purchase PCAT bonds that could not be sold to capital market investors.

Furthermore, in contrast to the ACA's individual mandate, a federal mandate requiring businesses to purchase adequate pandemic insurance may well be within Congress's power to regulate commerce.[241] The Commerce Clause gives Congress general authority to regulate business.[242] Unlike individuals,[243] most businesses are involved in interstate commerce, and a pandemic can close down businesses and seriously harm the national

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238.   *See id.* at 575.

239.   *See id.* at 574. *Cf. id.* at 566 (finding the opt-out payment to be reasonable because it is significantly cheaper than purchasing healthcare insurance).

240.   *Id.* at 567 ("None of this is to say that the payment is not intended to affect individual conduct. Although the payment will raise considerable revenue, it is plainly designed to expand health insurance coverage.").

241.   The Necessary and Proper Clause of the Constitution may provide even further authority for Congress to require businesses to purchase pandemic insurance. *Cf.* McCulloch v. Maryland, 17 U.S. 316, 357 (1819) (interpreting that Clause to support Congress's power to charter a national bank). That Clause underpins Congress's power to enact the Federal Deposit Insurance Act, 12 U.S.C. §§ 1811, 1814 (1913), under which banks are required to insure deposits as a condition of their operation. MICHAEL S. BARR, HOWELL JACKSON, & MARGARET TAHYAR, FINANCIAL REGULATION: LAW AND POLICY 173 (2d ed. 2018). Under that Act, banks must pay insurance premiums, adjusted for each bank's size, complexity, and risk profile, to the FDIC. *See id.* at 252–53. A pandemic insurance requirement could mirror the deposit-insurance requirement. Businesses would pay premiums, calculated based on a business's riskiness and the losses it could inflict on the insurance fund, to a federal agency tasked with collecting and distributing funds during a pandemic.

242.   *See Sebelius*, 567 U.S. at 536 (citing U.S. v. Morrison, 539 U.S. 598, 609 (2000)) ("Congress may regulate 'the channels of interstate commerce,' 'persons or things in interstate commerce,' and 'those activities that substantially affect interstate commerce.'"). *See, e.g.*, 42 U.S.C. § 2000(a), (c) (prohibiting businesses engaged in commerce from discriminating based on race, color, religion, or national origin); 21 USC § 603 (regulating the meat products to be used in commerce); 21 U.S.C. § 331(a) (barring the "introduction into interstate commerce of any food, drug, device, tobacco product, or cosmetic that is adulterated or misbranded").

243.   *Cf. Sebelius*, 567 U.S. at 572 (the Court's primary concern with upholding the ACA's individual mandate under the Commerce Clause was that individuals generally do not participate in interstate commerce).

economy.[244] The Court has been more willing to use the Commerce Clause to uphold Congressional regulation of activities that have a substantial impact on interstate commerce.[245]

D. Analyzing Government Risk-Sharing

Pandemic-risk protection may not yet be commercially feasible without the government bearing at least some portion of the risk.[246] To that end, the government almost certainly would have to purchase any shortfall between the principal amount of PCAT bonds that would need to be issued to indemnify the insurers and the principal amount of those bonds that could be sold to capital market investors. In the United States, there is significant precedent for the federal government to facilitate socially important projects by sharing in their risk.[247]

Implementing this public-private risk sharing, and determining what should be the relative priority between the government and the private sector—for example, should it be *pari passu*, senior, or subordinated—are complicated issues that not only mix law and economic considerations but also connect investments and legal guarantees. For clarity, this Article engages in an integrated law and economics analysis of government risk-sharing in Section III.C.

Another issue that mixes law and business considerations is defining the insurance-payment trigger. Among other consequences, that definition will impact the priority and timing of the SPV's obligations to pay principal and interest to CAT bond investors and, by subordinating those payments, indemnification to the insurer.[248] Ultimately, however, defining the insurance-payment trigger will be a business decision. Chubb's Pandemic Business Interruption Program suggests several possible triggers, including a Declaration of Emergency by the U.S. Department of Health and Human Services or the President, the occurrence of a government-enforced lockdown, or reliance on triggering events specified by the U.S. Centers for Disease Control and Prevention based on medical criteria.[249]

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244. A federal mandate requiring businesses to purchase adequate pandemic insurance should exempt businesses that are not adversely affected by pandemics. Identifying those businesses is beyond this Article's scope.

245. *See, e.g.*, Gonzalez v. Raich, 545 U.S. 1, 25–26 (2005) (holding that Congress may regulate a local activity that is not itself economic if it is a part of a "class of activities" that has a substantial impact on interstate commerce).

246. *See infra* note 259 and accompanying text.

247. *See infra* notes 316–359 and accompanying text.

248. *See supra* notes 42– 45 and accompanying text.

249. *See* CHUBB, PANDEMIC BUSINESS INTERRUPTION PROGRAM 6 (July 8, 2020), https://www.chubb.com/content/dam/chubb-sites/chubb-com/us-en/about-chubb/pandemic-business-

III. RESOLVING THE ECONOMIC CHALLENGES

Recall that the fundamental economic challenge is developing a large enough market for PCAT bonds to enable risk securitization to fund the level of pandemic insurance that businesses should be required to purchase.[250] As discussed, capital market investors have shown strong demand for CAT bonds.[251] $16.4 billion of new CAT bonds were issued in 2020, up from $11.1 billion issued in 2019.[252] The risk-capital outstanding under CAT bonds increased during that same period from $40.7 billion to $46.4 billion,[253] and CAT bond issuance is surging in 2020.[254]

That might seem like a lot, but it is tiny compared to the U.S. government's $2.2 trillion bailout package for COVID-19 or its $750 billion bailout package during the global financial crisis.[255] Moreover, the foregoing analyses on CAT bond issuance and risk-capital outstanding only minimally, at best, take PCAT bonds—which, to date, only have been issued as part of the World Bank's PEF Facility[256]—into account.[257]

Developing a large enough market for PCAT bonds therefore almost certainly will require the federal government to purchase a significant amount of those bonds.[258] This parallels the widespread insight that pandemic-risk protection may not be commercially feasible without the government bearing some portion of the risk.[259]

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interruption-program/documents/pdf/pandemic-business-interruption-program.pdf [https://perma.cc/938X-YN7S].

250.   *See supra* Section I.C.2.

251.   *See supra* notes 29–32 and accompanying text.

252.   *See Facts + Statistics: Catastrophe Bonds*, INS. INFO. INST., https://www.iii.org/fact-statistic/facts-statistics-catastrophe-bonds [https://perma.cc/SL92-P77J] (reporting data from Artemis). *See also How Record Catastrophe Bond Issuances Are Changing the Alternative Investment Landscape*, ONE BRIEF, https://theonebrief.com/how-record-catastrophe-bond-issuances-are-changing-the-alternative-investment-landscape/ [https://perma.cc/A696-BZ84].

253.   *See* INS. INFO. INST., *supra* note 252.

254.   *See supra* note 35 and accompanying text.

255.   *See* Larisa Yarovaya, John W. Goodell & Brian Lucey, *Financial Contagion During the COVID-19 Pandemic*, FINREG BLOG (June 16, 2020), https://sites.law.duke.edu/thefinregblog/2020/06/16/financial-contagion-during-the-covid-19-pandemic/ [https://perma.cc/8VE3-N3PY].

256.   *See supra* notes 78–82 and accompanying text.

257.   It is unclear if the above data include the World Bank's PCAT bonds. *Cf.* Lucian McMahon, *All About Pandemic Catastrophe Bonds*, INS. INFO. INST. (Apr. 29, 2019), https://www.iii.org/insuranceindustryblog/tag/catastrophe-bonds/ [https://perma.cc/TH5W-86GW] (referencing the World Bank's PCAT bonds but not stating whether those bonds were included in the Insurance Information Institute's data).

258.   *See supra* note 3 and accompanying text.

259.   *See, e.g.*, INS. COUNCIL OF AUSTL., INSURING FOR PANDEMICS STUDY 5 (July 2020), concluding that because pandemic "risk violates most principles of insurability," especially insofar as the "magnitude of the losses is significant, well in excess of insurance sector capital," global "aggregation of loss means risk cannot be diversified (a key tenet of insurance mathematics)," the "premiums would be high, and most likely unaffordable," and the "losses are hard to define" and "(at

That calls into question what level of pandemic insurance businesses should be required to purchase. In part based on the experience with COVID-19, Section A examines factors relevant to estimating that level.[260] That estimate also will indicate the principal amount of PCAT bonds that will need to be issued to fund that level of insurance. Section B then attempts to estimate what portion of those bonds could be sold to capital market investors.[261] That estimate will depend, in part, on the credit rating of, and the interest rate payable on, those bonds.[262] The interest rate payable on those bonds will influence, in turn, the premiums that businesses must pay to insurers for the pandemic insurance, and thus the premiums that insurers must pay to the SPVs for their indemnifications; these amounts are correlated because the premiums are passed through to help pay interest on the SPV's PCAT bonds.[263]

Because the federal government almost certainly would have to purchase any shortfall between the principal amount of PCAT bonds that would need to be issued to indemnify the insurers and the principal amount of those bonds that could be sold to capital market investors, Section C analyzes government risk-sharing in purchasing that shortfall—including whether the government-purchased bonds should be *pari passu* or subordinate in priority to the capital-market-investor-purchased bonds.[264]

Finally, Section D engages in a cost-benefit analysis to try, among other things, to assess the fairness of the PCAT bond interest rates.[265] Given the unpredictability of both the occurrence and duration of pandemics, some have questioned whether fair pricing is realistic.[266]

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least currently) are not calculable prior to a pandemic occurring," a "traditional private sector insurance risk transfer solution to address pandemic risk [is] effectively impossible at this time." "Government policy [therefore] plays an important role in structuring solutions" because "principles of insurability are not satisfied." *Id. Cf.* Weinberger, *supra* note 11 (reporting that "[t]he federal government is likely going to have to provide some sort of global [pandemic risk] coverage, most insurers say" and also observing that both a federal congressperson proposing legislation and a leading private insurer "envision a program where insurers offer pandemic coverage policies to businesses with the federal government bearing most of the coverage costs."). Whether the federal government feasibly would purchase those PCAT bonds is a political question that is beyond this Article's scope.

260.   *Infra* Section III.A.
261.   *Infra* Section III.B.
262.   That, in turn, would depend on whether investors take a first-loss, second-loss, or *pari passu* position.
263.   *See supra* note 261 and accompanying text; *see infra* note 282 and accompanying text.
264.   *Infra* Section III.C.
265.   *Infra* Section III.D.
266.   *Cf.* Dror Etzion, Emmanuel Kypraios & Bernard Forgues, *Employing Finance in Pursuit of the Sustainable Development Goals: The Promise and Perils of Catastrophe Bonds*, 5 ACAD. MGMT. DISCOVERIES 530, 530 (2019) (arguing that using CAT bonds to insure losses caused by extreme climate events makes bond investors richer by systematically overestimating risks and artificially inflating bond returns).

A. *Estimating the Level of Pandemic Insurance that Businesses Should Purchase*

Although this Article contemplates the federal government requiring businesses to purchase some minimum level of pandemic insurance, it does not yet estimate that level. In part based on the COVID-19 pandemic, consider what factors should be relevant to making that estimate.

The full extent of the economic fallout from the COVID-19 pandemic is still being felt by businesses, but the size of that impact is beginning to take shape. While pandemic insurance might be required to cover the full amount of that impact, the more critical—and, given the scale of trying to cover a pandemic's full impact, arguably more pragmatic—level would appear to be the amount of liquidity needed to help firms survive during a pandemic. In this context, liquidity means the amount of cash that firms need to pay their obligations as they come due.[267] An inability to pay such obligations as they come due is the principal reason that businesses fail.[268] Conversely, enabling businesses to pay those obligations on a timely basis would enable economic recovery and protect employment.[269]

The amount of liquidity needed to help a firm survive during a pandemic depends in large part, however, on the length of the pandemic and its impact on the ability of the firm to continue operating during its continuance.[270] As

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267. *See Working Capital Basics: Liquidity and the Cash Cycle*, AM. BANKR. INST. (July 1, 2001), https://www.abi.org/abi-journal/working-capital-basics-liquidity-and-the-cash-cycle, [https://perma.cc/9C7F-4L6U].

268. *See, e.g.*, Jean Murray, *Common Reasons Why Companies Go Bankrupt*, BALANCE (July 8, 2019), https://www.thebalancesmb.com/why-do-businesses-go-bankrupt-a-crisis-of-liquidity-3974597 [https://perma.cc/VD4A-6G9E]; Mike Harmon & Victoria Ivashina, *Managing the Liquidity Crisis*, HARV. BUS. REV. (Apr. 9, 2020), https://hbr.org/2020/04/managing-the-liquidity-crisis [https://perma.cc/MUA9-KBPL].

269. *Cf.* Letter from Bankr. & COVID-19 Working Grp. to Senators Mitch McConnell & Charles Schumer, Representatives Nancy Pelosi & Kevin McCarthy (July 10, 2020) (on file with author) (observing that liquidity is essential for distressed companies to survive, and explaining that illiquidity "would imperil the ability of the economy to recover quickly and adversely affect employment and the country as a whole"). One of the primary goals of the Dodd-Frank Act, for example, was to ensure that systemically important financial institutions maintain sufficient liquidity to enable them to survive economic downturns. *See* MARK LABONTE & DAVID W. PERKINS, CONG. RSCH. SERV., R40536, CRS REPORT FOR CONGRESS: BANK SYSTEMIC RISK REGULATION: THE $50 BILLION THRESHOLD IN THE DODD-FRANK ACT 2 (2017).

270. Among small businesses surveyed in the early days of the COVID-19 pandemic, 72% responded they would be able to reopen if there was only one month of disruption. Alexander W. Bartik, Marianne Bertrand, Zoe Cullen, Edward L. Glaeser, Michael Lucac & Christopher Stanton, *The Impact of COVID-19 on Small Business Outcomes and Expectations*, 117 PROCEEDINGS NAT'L ACAD. SCI. 17,656, 17,656 (2020), https://www.pnas.org/content/117/30/17656 [https://perma.cc/L77P-T4RQ]. However, only 47% responded they would be able to reopen if the disruption continued for four months. *See id.* Six months into the pandemic, 55% of small businesses surveyed expected recovery to take at least another six months with another 6% believing they would never fully recover financially. *Small Business Coronavirus Impact Poll*, U.S. CHAMBER COM. (June 3, 2020, 8:00 AM), https://www.uschamber.com/report/small-business-coronavirus-impact-poll-june

COVID-19 has shown, it is difficult ex ante to predict the length of a pandemic. Furthermore, the impact on a firm's ability to continue operating during a pandemic depends not only on the severity of the pandemic but also on the nature of the firm and applicable government public-safety measures. During the COVID-19 pandemic, for example, pharmacies, grocery stores, and gas stations were deemed essential and allowed to operate whereas restaurants and bars were closed or allowed only limited operations.[271] Even businesses deemed to be essential suffered some interruption due to the need to satisfy government health and safety requirements and customer expectations, including purchasing additional cleaning supplies and sufficient quantities of masks and gloves for employees and providing appropriate store signage.[272]

Given these and other potentially indeterminate variables, this Article does not independently attempt to calculate the amount of liquidity that pandemic insurance should be required to cover. Rather, the Article looks in the first instance to pandemic-insurance coverage numbers that others have proposed. The most notable example is the $1.150 trillion program of pandemic business-interruption insurance recently proposed by Chubb.[273] Chubb explains this number as the sum of small business liquidity needs (estimated at $750 billion, based on a fourteen-day waiting period and a multiple of three-month payroll expenses)[274] plus large and medium business liquidity needs (estimated at $400 billion).[275] The discussion below initially will use that number,[276] without necessarily implying it is correct.

[https://perma.cc/9SZB-QUF3]. Furthermore, recovery remains uncertain for many businesses given that they likely face reduced demand, altered expectations from customers, and operational challenges borne from government mandates meant to promote public health and welfare.

271. *See, e.g.*, N.Y. Exec. Order No. 202.6 (March 7, 2020), https://www.governor.ny.gov/news/no-2026-continuing-temporary-suspension-and-modification-laws-relating-disaster-emergency [https://perma.cc/MBL6-NF8K].

272. *See, e.g.*, Nathaniel Meyersohn & Sara Ashley O'Brien, *Stores Are Scrambling to Get Masks for Their Workers. It's No Easy Task*, CNN Bus. (Apr. 5, 2020, 12:03 PM), https://www.cnn.com/2020/04/05/business/masks-workers-amazon-instacart-walmart-lowes/index.html [https://perma.cc/7UA2-KFW6]; Daniella Diaz, Geneva Sands & Cristina Alesci, *Protective Equipment Costs Increase over 1,000% Amid Competition and Surge in Demand*, CNN Pol. (Apr. 16, 2020, 11:13 PM), https://www.cnn.com/2020/04/16/politics/ppe-price-costs-rising-economy-personal-protective-equipment/index.html [https://perma.cc/5CQM-8GEG].

273. *See infra* notes 335–340 and accompanying text. By comparison, the proposed "Black Swan Re" program from Lloyd's of London calls for a broader government and insurance industry reinsurance pool for business interruption insurance that goes beyond pandemics. *See* LLOYD'S OF LONDON, *infra* note 295, at 29–30. It would cover non-damage business interruption arising from a variety of systemic and catastrophic events. *See id.* Under such a plan, industry pooled capital would cover future systemic events, with government guarantees to pay out if the pool ever had insufficient funds. *See id.*

274. *See* CHUBB, *supra* note 249, at 6.

275. *See id.* at 4. For Chubb's distinction between these types of businesses, see *infra* note 337.

276. The discussion also considers a much smaller pilot project. *See infra* notes 307–309 and accompanying text.

B. Estimating the Market for PCAT Bonds

Assuming that businesses should be required to purchase at least $1.150 trillion of pandemic insurance, that same order of magnitude of PCAT bonds would need to be issued to indemnify the providers of that insurance. This Section attempts to estimate what portion of those bonds could be sold to capital market investors.

As mentioned, that estimate will depend, in part, on the credit rating of, and the interest rate payable on, those bonds.[277] That, in turn, will depend on whether investors take a first-loss, second-loss, or *pari passu* position with respect to other bondholders, including the government.[278] The interest rate also will depend on the premiums that businesses pay to insurers for the pandemic insurance,[279] and thus the premiums that insurers pay to the SPVs for their indemnifications.[280]

All things being equal, investors naturally will want the most senior priority with respect to other bondholders as well as the highest interest rate. There is a market balance, though: the higher the priority (and thus the higher the credit rating, which should correlate with the priority), the lower the repayment risk and thus the lower the relative interest rate that the bonds need to bear to attract investors.[281]

Because of the inherent uncertainty over the occurrence, severity, and length of future pandemics,[282] some capital market investors may demand a relatively high interest rate—perhaps even compared to similarly rated corporate bonds[283]—to induce them to purchase PCAT bonds. Although

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277. *See supra* note 262 and accompanying text.

278. *See supra* note 262. *See also infra* note 313 and accompanying text.

279. Although the calculation of those premiums is beyond the scope of this Article, it should be noted that small and medium-sized businesses are more subject to pandemic-related risk than large businesses. Jackson & Schwarcz, *supra* note 2. *Cf.* James Kwak, *The End of Small Business*, WASH. POST (July 9, 2020), https://www.washingtonpost.com/outlook/2020/07/09/after-covid-19-giant-corporations-chains-may-be-only-ones-left/?arc404=true [https://perma.cc/9JCH-DFA4] (arguing that large businesses like Amazon and Walmart have a competitive advantage in pandemics over small businesses, which do not have the resources to build new systems for curbside pick-up and safe delivery of goods). At least on a relative basis, therefore, small and medium-sized businesses should be subject to paying higher premiums. Alternatively, premiums could be sized on an ability-to-pay basis, with the largest firms being better able to afford, and thus being required to pay, the highest premiums. That alternative, however, might be interpreted under *Sebelius* as the forced consumption of unwanted goods rather than a tax. *Cf. supra* notes 236–240 and accompanying text (discussing the *Sebelius* case).

280. Recall that these amounts are correlated because the premiums are passed through to help pay interest on the SPV's PCAT bonds. *See supra* note 262 and accompanying text.

281. *Senior   Debt*,   CORP.   FIN.   INST., https://corporatefinanceinstitute.com/resources/knowledge/finance/senior-debt/ [https://perma.cc/ZJ7E-4CN8].

282. *See supra* notes 270–272 and accompanying text.

283. Theoretically, credit rating agencies view their ratings as universal indicators of risk, such that an A-rated PCAT bond and an A-rated corporate bond should have the same risk. *See, e.g.*, *Bond Ratings*,   FIDELITY,   https://www.fidelity.com/learning-center/investment-products/fixed-income-

some firms claim to be able to quantify pandemic risk,[284] that quantification almost certainly falls short of the rigorous actuarial data that customarily underlies insurance.[285] Countering that, however, is the fact that PCAT bonds would provide investors with a diversified return because pandemics occur randomly and are not correlated with standard economic risks.[286]

Furthermore, investors may—and arguably, should—discount pandemic-related risk on the basis that society is learning from COVID-19. The economic impact of future pandemics could be relatively low, for example, because COVID-19 has exposed the myriad ways that businesses and individuals were unprepared for a pandemic. Most businesses did not have clear protocols for operating safely in the midst of a pandemic,[287] and most Americans had never even worn face masks.[288] In response to COVID-19, businesses have been required to adopt, and individuals have begun to adapt to, pandemic-safety strategies.[289] Arguably, that will make society better prepared to endure the next pandemic with less severe disruption. If so, that might limit the payout under pandemic-risk insurance, and hence the loss of value to CAT bond investors.[290]

To increase the market for PCAT bonds, this Article already has discussed implementing a senior-subordinate structure to provide credit enhancement.[291] Such a structure would help to increase capital market

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bonds/bond-ratings [https://perma.cc/X3JK-YWN3]. In practice, though, capital market investors often further differentiate risk based on the nature of the bond. *See Understanding Bonds and Their Risks*, MERRILL, https://www.merrilledge.com/article/understanding-bonds-and-their-risks [https://perma.cc/R3K7-EUZY].

284. *See supra* notes 13–14 and accompanying text.

285. *Cf.* CHARLES NYCE, AM. INST. CPCU, PREDICTIVE ANALYTICS WHITE PAPER 1, 3 (2007) (demonstrating the use of predictive analytics by insurance companies and explaining that proprietary data, as well as data from "numerous third party sources," allow insurance companies to develop predictive models by which to determine premiums). On the other hand, the relatively abstract nature of a pandemic might cause some investors to view their risk-taking more abstractly, causing them to underestimate the risk. *Cf.* Steven L. Schwarcz, *Regulating Financial Guarantors*, 11 HARV. BUS. L. REV. (forthcoming 2021) (examining how abstraction bias can distort the assessment of risks that lack rigorous statistical data).

286. *See supra* notes 56–58 and accompanying text.

287. *See* Pacheco, *supra* note 9 (explaining the changes businesses have had to make in the face of COVID-19 as well as the cost of those changes).

288. *See* Uri Friedman, *Face Masks Are In*, ATLANTIC, (Apr. 2, 2020), https://www.theatlantic.com/politics/archive/2020/04/america-asia-face-mask-coronavirus/609283/ [https://perma.cc/3T4F-VWHL].

289. *See* CTRS. FOR DISEASE CONTROL & PREVENTION, INTERIM GUIDANCE FOR BUSINESSES AND EMPLOYERS RESPONDING TO CORONAVIRUS DISEASE 2019 (COVID-19) (Mar. 8, 2021), https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-business-response.html [https://perma.cc/MX3W-RQ3G] (outlining strategies and recommendations for safely operating a workplace during the pandemic).

290. For parametric payouts, however, there would be no difference if the economic impact triggers the payout. *See supra* notes 58–59 & 98–101 and accompanying text (explaining parametric insurance payouts).

291. *See supra* notes 192–197 and accompanying text.

investor demand by allocating the most senior (albeit low-yield) bonds to more risk-averse investors and the more junior (albeit high-yield) bonds to high-risk investors.[292] Also, if the federal government were to purchase subordinated (especially, the most deeply subordinated) PCAT bonds to make up the shortfall, that itself would create a second senior-subordinate structure—in this case, between the capital market investors and the government—which would further credit enhance the capital market investors and increase their willingness to invest.[293]

As the foregoing discussion shows, any estimate of the principal amount of PCAT bonds that capital market investors would be likely to purchase would depend on a range of variables.[294] Without holding those variables constant, this Article is unable to make that estimate. In theory, though, capital market investors potentially could purchase a significant portion of the approximately $1.150 trillion of the contemplated PCAT bonds. The capital markets are estimated at roughly $180 trillion,[295] with the "fixed income" portion—the portion representing bonds[296]—estimated at roughly $123 trillion.[297] The contemplated PCAT bonds would represent just 1% of outstanding bond investments. It appears that investors in a post COVID-19 world would be interested in purchasing PCAT bonds.[298] Rating agency Standard & Poor's observes, for example, that "[t]he COVID-19 pandemic has showcased the value of publicly traded catastrophe bonds (cat bonds) to investors, offering a liquid asset class that was not correlated with the current volatile financial markets."[299]

Even if capital market investors fail to purchase a significant portion of the $1.150 trillion of the contemplated PCAT bonds, any portion they purchase would contribute, pro tanto, to reducing the government's share of risk in controlling pandemic-related harm. That could help, for example, to facilitate Chubb's proposed public-private insurance partnership.[300] Chubb proposes that the federal government assume approximately $1 trillion

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292. *See supra* note 192 and accompanying text.

293. *See infra* note 312 and accompanying text.

294. *Supra* notes 284–285 and accompanying text.

295. *See* LLOYD'S OF LONDON, SUPPORTING GLOBAL RECOVERY AND RESILIENCE FOR CUSTOMERS AND ECONOMIES 24 (2020).

296. Bonds are "the most common type of fixed-income security." *See* Chris B. Murphy, *Fixed-Income Security*, INVESTOPEDIA (Aug. 31, 2020), https://www.investopedia.com/terms/f/fixed-incomesecurity.asp [https://perma.cc/UA6A-RFX4].

297. Katie Kolchin, Justnya Podziemska & Ali Mostafa, *Research Quarterly: Fixed Income – Issuance and Trading*, SIFMA (July 19, 2021), https://www.sifma.org/resources/research/research-quarterly-fixed-income-issuance-and-trading-second-quarter-2020/ [https://perma.cc/S6KL-SB49]. The U.S. fixed-income portion alone was estimated as $47 trillion. *See id.*

298. *See* Evans, *supra* note 52.

299. *Id.*

300. *See infra* notes 335–340 and accompanying text.

dollars of pandemic-related risk under that partnership.[301] Every $300 million of PCAT bonds—the amount of a single standard CAT bond issuance[302]—that capital market investors purchase would reduce the federal government's pandemic-related risk-sharing by $300 million. Similarly, if capital market investors purchase $5 billion of PCAT bonds, which is merely half of recent yearly new CAT bond issuance[303] and only a miniscule fraction[304] of outstanding capital market bond investments, that would reduce by $5 billion the government's pandemic-related risk-sharing. Whether or not significant on a relative basis, $5 billion is real money.[305]

C. Analyzing Government Risk-Sharing

As discussed, pandemic-risk protection may not yet be commercially feasible without the government bearing at least some portion of the risk.[306] To that end, the federal government almost certainly would have to purchase any shortfall between the principal amount of PCAT bonds that would need to be issued to indemnify the insurers and the principal amount of those bonds that could be sold to capital market investors.[307] If insurers were to fully cover pandemic-related risk, the analysis in sections A and B above suggests that the high end of that shortfall might be in the hundreds of billions of dollars.

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301. Chubb proposes that the federal government covers, for small businesses, at least 88% of the first $250 billion layer of losses and all of the next $500 billion layer of losses; and, for large and medium businesses, Chubb proposes that the federal government covers $400 billion of losses less the losses covered by private insurers, which would be limited to $15 billion in the first year and $30 billion by year 10 of the program. *See infra* notes 339–341 and accompanying text. That could be as much as 0.88 x $250 billion + $500 billion + $400 billion - $[15/30] = $[220 + 500 + 400 – {15/30}] = between $1.090 trillion and $1.105 trillion.

302. *See supra* notes 63, 72 and accompanying text.

303. *See supra* notes 252–254 and accompanying text.

304. The portion of the capital markets representing bonds is estimated at roughly $123 trillion. *See supra* notes 295–297 and accompanying text. $5 billion is less than half of 1% of 1% of that number.

305. There might be other cost saving and efficiency opportunities. Consider, for example, how many SPVs should be utilized. Utilizing a single SPV, perhaps sponsored by a governmental pandemic catastrophe fund, would reduce transaction costs related to organization, staffing, and (if applicable) bond rating. In contrast, utilizing multiple SPVs—for example, each applicable insurer could sponsor its own SPV—might help to maximize PCAT bond issuance. Each SPV could vary the terms of its PCAT bonds, thereby collectively appealing to a more diversified, and thus larger, group of investors (although theoretically, that could be accomplished by a single SPV issuing different classes of PCAT bonds under a master trust structure). The author recently discussed, confidentially, with senior officers of a major rating agency whether it would be better to have one large statistically integrated PCAT bond offering, where private investors ratably take on the pandemic risk, or a separate PCAT bond offering for each specific pandemic risk. In response, they observed that although diversification can reduce tail risk statistically, PCAT bond issuances should not be diversified solely for the sake of diversification. In other words, the answer would be fact specific. Videoconference Interview with senior members of major rating agency (Oct. 23, 2020).

306. *See supra* note 259 and accompanying text.

307. *See supra* notes 262, 259 and accompanying text. If multiple SPVs issue the PCAT bonds, this shortfall would be the sum of each such's SPV's shortfall.

A more limited pilot project, however, could start with lower pandemic-related risk coverage and thus a much lower shortfall that the government would need to cover. If, for example, a pilot project requires businesses to purchase $10 billion, rather than $1.150 trillion, of pandemic insurance, at most $10 billion principal amount of PCAT bonds would need to be issued to indemnify the providers of that insurance.[308] Capital market investors might well purchase at least half of those bonds,[309] leaving only a $5 billion shortfall of PCAT bonds that the government would need to purchase.[310] The World Bank's PEF project represents a precedent for issuing PCAT bonds in a pilot project of limited scope.[311]

Whatever the shortfall, should the federal government's priority in PCAT bonds purchased to make up the shortfall be *pari passu* with, or senior or subordinated to, the priority of PCAT bonds purchased by capital market investors? Answering that question depends not only on political factors but also on how a lower government priority could improve the credit rating on more senior PCAT bonds,[312] and thus the willingness of the private sector to invest in those more senior bonds. By making the private sector more willing to invest in those bonds, the answer could reduce the shortfall that the government would have to purchase.[313]

In this context, the federal government would have *pari passu* priority if its purchased bonds were payable equally and ratably with other investor-

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308. *Cf. supra* notes 273–277 and accompanying text (calculating the amount of PCAT bonds that would need to be issued). In his T20 Policy Brief to the G20 nations, the author proposed specific steps to implement such a pilot project. *See* STEVEN L. SCHWARCZ, USING RISK SECURITIZATION TO INSURE AGAINST PANDEMIC-RELATED RISK 4 (Sept. 2021), https://www.t20italy.org/wp-content/uploads/2021/09/PB-TF9-5.pdf [https://perma.cc/2MKG-E9G7]. For example, the G20 might ask the Financial Stability Board, the Bank for International Settlements, or the International Monetary Fund—or even the World Bank, which may well have experienced people who will have learned from its first attempt—to take the lead in implementing the project. *See id.* at 7. One or more G20 nations also might be interested in engaging in that project. *See id.* To implement the project, a nation could require a relatively limited number of firms—at the outset, perhaps just globally systemically important businesses—to insure against pandemic-related risks. *See id.* As discussed, the amount of that insurance should be the amount of liquidity needed to help those firms survive during a pandemic, which will depend on various factors. *See id.* Once that amount is determined, the same order of magnitude of CAT bonds would need to be issued to indemnify the providers of that insurance. *Id.* The providers of that insurance could be one or more insurers or reinsurers or even a government/multinational-sponsored catastrophe fund. *Id.* Such insurance provider(s) would set up an SPV to issue the CAT bonds. *Id.* Although capital market investors might purchase the entire CAT bond issuance, some government or multinational body should be prepared either to purchase any shortfall or to guarantee the CAT bonds to the extent necessary to motivate capital market investors to purchase all of those bonds. *Id.*

309. *See supra* notes 303–304 and accompanying text.

310. *See supra* notes 307–309 and accompanying text.

311. *See* Steven L. Schwarcz, author, & Mukesh Chawla, Bank Grp. Sr. Adviser to the PEF program, at the annual ABA Section on Business Law meeting (Sept. 22, 2020).

312. If the government purchased bonds with a lower priority, that would effectively credit enhance the more senior bonds in the same way that subordinated bonds in a senior-subordinate structure would credit enhance the more senior bonds. *See supra* notes 192–197, 293 and accompanying text.

313. *See supra* note 262 and accompanying text.

purchased bonds;[314] senior priority if its (i.e. the federal government's) purchased bonds were payable before other investor-purchased bonds were payable—in which case those other investors would be taking a first-loss risk and the government would be taking a second-loss risk; and subordinated priority if its purchased bonds were payable only after the other investor-purchased bonds were payable—in which case the government would be taking a first-loss risk and the other investors would be taking a second-loss risk.[315]

There are precedents for *pari passu*, senior (second-loss), and even subordinated (first-loss) risk-sharing by the federal government in order to facilitate socially important projects. The CARES Act's $600 billion Main Street Lending Program represents a *pari passu* risk-sharing precedent.[316] Main Street is intended to fund small and medium-sized enterprises (SMEs).[317] It contemplates lending, on otherwise commercially reasonable terms, to otherwise eligible businesses that would be viable but for the COVID-19 pandemic.[318] Thus, it is intended to fund SMEs that were in sound financial condition prior to the onset of the COVID-19 pandemic, in order to maintain their operations and payroll until conditions normalize. Also, it is intended to be fully repayable by the borrowers.[319] Main Street program loans are made by Eligible Lenders, which at the outset are limited primarily to FDIC-insured banks.[320] Eligible Lenders are expected to assess the financial condition and creditworthiness of their borrowers and to approve only loans they believe will be repaid.[321]

After each loan is made, the Eligible Lender will sell an 85% or 95% (depending on the type of loan)[322] undivided interest, or "loan participation," in that loan to a special purpose vehicle (the "Main Street

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314. *Cf.* Rodrigo Olivares-Caminal, *The Pari Passu Clause in Sovereign Debt Instruments: Developments in Recent Litigation*, 72 BIS Papers 121, at 121 (discussing the meaning of *pari passu*).

315. *See* Eric Fontinelle, *4 Basic Things to Know About Bonds*, INVESTOPEDIA, (Aug. 26, 2021), https://www.investopedia.com/articles/bonds/08/bond-market-basics.asp [https://perma.cc/ZVL9-XMVN] ("Senior debt is debt that must be paid first, followed by junior (subordinated) debt.").

316. Coronavirus Economic Stabilization (CARES Act), 15 U.S.C. § 9042(c)(3)(D)(ii).

317. *See Main Street Lending Program*, BD. OF GOVERNORS OF THE FED. RSRV. SYS., (Sep. 13, 2021), https://www.federalreserve.gov/monetarypolicy/mainstreetlending.htm [https://perma.cc/67T4-9E4A].

318. *See id.*

319. FED. RSRV. BANK OF BOS., MAIN STREET LENDING PROGRAM FREQUENTLY ASKED QUESTIONS: FOR-PROFIT FREQUENTLY ASKED QUESTIONS 11 (Dec. 29, 2020) ("Main street loans are full-recourse loans and are not forgivable.").

320. *See id.* at 63.

321. *See id.*

322. The Main Street program includes three facilities, each authorized by the Fed under § 13(3) of the Federal Reserve Act. These facilities use the same Eligible Lender and Eligible Borrower criteria and have many of similar features, including for loan maturities (including one-year payment deferrals on principal and interest) and interest rates. *See* Federal Reserve Act, Pub. L. No. 63-43, § 13(3), 38 Stat. 251 (1913).

SPV") established and operated by the Federal Reserve Bank of Boston. The Department of the Treasury has made a $75 billion equity investment in the Main Street SPV (appropriated under section 4027 of CARES Act).[323] These sales of loan participations are to be structured as true sales.[324] So long as the Main Street SPV has any liability on a loan, the Eligible Lender must retain its 15% or 5% (as the case may be) risk on that loan.[325] The Eligible Lender and the Main Street SPV—and thus the federal government, to the extent of its $75 billion equity—would share loan losses *pari passu*, according to their relevant percentages.[326]

The Affordable Care Act[327] represents an arguably first-loss government risk-sharing precedent in order to facilitate a socially important project. As part of that Act, Congress approved a Risk Corridor program designed to "cabin the risks" of health insurers by obligating the federal government to compensate those insurers for unexpectedly unprofitable plans during the first three years of the Act's effectiveness.[328]

The Price-Anderson Act[329] represents a second-loss government risk-sharing precedent, in order to facilitate nuclear energy development. Under that Act, the federal government provided up to $500 million of protection for nuclear reactor accident risk, payable only after the industry-provided $60 million first-loss position became depleted.[330] However, once government risk-sharing was no longer needed because nuclear-reactor accident risk became commercially insurable,[331] the government terminated its risk-sharing.[332]

> The [nuclear energy] industry in its early stages of development . . . was not capable of assuming [the] unique risk [associated with nuclear incidents], which has generally been considered to have extremely low probability but potentially large consequences. . . .

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323. MAIN STREET LENDING PROGRAM FREQUENTLY ASKED QUESTIONS: FOR-PROFIT FREQUENTLY ASKED QUESTIONS, *supra* note 319, at 13.

324. *See id.* at 67.

325. *See id.* at 78, 91.

326. *See id.* at 13, 14, 17.

327. Patient Protection and Affordable Care Act, Pub. L. No. 111-148, 124 Stat. 119 (2010).

328. *See* Me. Cmty. Health Options v. United States, No. 18-1023, slip op. at 3–4 (Apr. 27, 2020).

329. Price-Anderson Act, Pub. L. No. 85-256, 71 Stat. 576 (1957).

330. *See supra* notes 18–19 and accompanying text.

331. *See supra* note 19 (observing that The Price-Anderson Nuclear Industries Indemnity Act of 1957 subsequently was amended to replace the federal government's second-loss position with fully privatized nuclear accident risk insurance).

332. *See* Keiki Kehoe, *The Price-Anderson Act: Reassessing the Government's Role in Underwriting the Risks of Nuclear Power*, 1 OUTLOOK ENVTL. J. 16, at 16–17 (1982) ("Amendments to the Act in 1975 restructured the $560 million pool to include more contributions from utilities and a gradual phase-out of the federal government's role. . . . The Price-Anderson Act was designed to expire in 10 years, after which time the insurance industry was expected to cover a great proportion – if not all – of the risks of nuclear power.").

> [T]he industry is just not reaching the point where the government's role can be phased out without the possibility of unduly disrupting the industry's development or of leaving the public with inadequate provision for relief from the highly improbable severe nuclear incident which the Act is designed to protect against.[333]

More recently, Chubb[334] has raised the possibility of the U.S. government sharing risk—what Chubb calls a "public-private partnership"[335]—in order to motivate insurers to extend business-interruption insurance to pandemics.[336] Although Chubb's proposal differentiates how that insurance would cover small businesses, on the one hand, and large and medium businesses on the other,[337] the basic principle is "[i]nsurance industry risk-sharing with the federal government,"[338] with the federal government taking the lion's share of the risk.[339] For small businesses, Chubb proposes two layers of pandemic-risk insurance: first, a $250 billion layer, for which private insurers would cover 6–12% of losses and the federal government would cover the remainder on a *pari passu* basis; and second, a $500 billion layer covered entirely by the federal government (effectively, therefore, first-loss risk-sharing with respect to that layer and a form of second-loss risk sharing with respect to the entire $750 billion of coverage).[340] For large and medium businesses, Chubb proposes $400 billion coverage, for which private insurers would cover the first 5% of claims with a $15 billion limit in the first year, rising to the first 10% of claims with a $30 billion limit by year ten of the program, with the federal government covering the remainder of the claims.[341] The rationale, according to Chubb, is "that only the federal government has sufficient

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333. S. REP. NO. 94-454, at 10 (1975) (the Senate Report for the 1975 amendment to the Price-Anderson Act which started gradually phasing out federal government risk-sharing).

334. Recall that Chubb is the world's largest publicly traded property-and-casualty insurance company. *See supra* note 27 and accompanying text.

335. *See The Chubb Pandemic Business Interruption Program*, CHUBB, https://www.chubb.com/us-en/about-chubb/pandemic-business-interruption-program.html [https://perma.cc/C9GE-WWHT].

336. *Cf.* Banham, *supra* note 7, and accompanying text (explaining why business-interruption insurance does not currently cover pandemics).

337. Chubb defines small businesses as having no more than 500 employees. CHUBB, *supra* note 274. In the event of a pandemic, Chubb predicts that small businesses are going to have the most urgent need for cash flow and liquidity while larger businesses are generally going to have more resources and better access to outside capital. CHUBB, THE ESSENTIAL COMPONENTS OF A SUCCESSFUL PANDEMIC BUSINESS INTERRUPTION PROGRAM 1 (July 8, 2020), https://www.chubb.com/us-en/_assets/doc/essential-components-of-a-successful-pandemic-bi-program-july-2020.pdf [https://perma.cc/M9LP-Y8WZ].

338. CHUBB, *supra* note 274, at 2.

339. *See id.*

340. *See id.* at 3.

341. *See id.* at 4.

resources to meet the full extent of pandemic loss, which is not insurable in the private sector."[342]

To inform how the federal government might share risk when purchasing PCAT bonds to make up the capital-market-investment shortfall[343]—on a first-loss, *pari passu*, or second-loss basis—consider how it shared risk in the three congressionally-enacted precedents. The Main Street Lending Program implemented a *pari passu* risk-sharing scheme to motivate bank lending to businesses that were otherwise in good financial standing prior to the COVID-19 crisis.[344] First-loss risk-sharing, in which the federal government bore the initial losses, may have over-protected banks, motivating them to lend to marginal businesses.[345] Second-loss risk-sharing, in which private lenders bore the initial losses, may have underprotected banks, insufficiently motivating them to lend to otherwise healthy businesses affected by pandemic uncertainties.[346]

The temporary first-loss protection provided by the Risk Corridor program of the Affordable Care Act was intended to help protect the insurance market against adverse selection and reduce premiums.[347] Without that program, insurers may have charged higher-than-necessary premiums in order to help offset the uncertain expense of high-cost enrollees, who previously were seen as either uninsurable or unattractive for insurance.[348] The temporary first-loss protection effectively subsidized insurers until sufficient information was generated to reduce that uncertainty and enable more accurate pricing of premiums.[349]

The Price-Anderson Act provided second-loss risk-sharing as an economic fallback. Given the uncertainties of nuclear-reactor accident risk, the insurance industry was only willing to provide coverage up to $50

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342. *Id.* at 3.

343. *See supra* notes 306–307 and accompanying text.

344. *See* William B. English & J. Nellie Liang, *Designing the Main Street Lending Program: Challenges and Options* 15, (Hutchins Ctr. on Fiscal & Monetary Pol'y, Working Paper No. 64, June 2020) https://www.brookings.edu/wp-content/uploads/2020/06/WP64_Liang-English_FINAL.pdf [https://perma.cc/7S25-S78R].

345. *See* Zachary Warmbrodt & Victoria Guida, *Fed's Massive 'Main Street' Business Rescue in Danger of Fizzling*, POLITICO (June 2, 2020, 6:07 PM), https://www.politico.com/news/2020/06/02/fed-reserve-main-street-program-297149 [https://perma.cc/VC5A-CW96].

346. *See* Pietro Calice, *Boosting Credit: Public Guarantees Can Help Mitigate Risk During COVID-19*, WORLD BANK BLOGS (May 28, 2020), https://blogs.worldbank.org/psd/boosting-credit-public-guarantees-can-help-mitigate-risk-during-covid-19 [https://perma.cc/NSW2-2QWT].

347. *See* 77 Fed. Reg. 17,219 (Mar. 23, 2012) (to be codified at 45 C.F.R. pt. 153).

348. *See* CYNTHIA COX, ASHLEY SEMANSKEE, GARY CLAXTON & LARRY LEVITT, EXPLAINING HEALTH CARE REFORM: RISK ADJUSTMENT, REINSURANCE, AND RISK CORRIDORS 1 (Aug. 17, 2016), https://www.kff.org/health-reform/issue-brief/explaining-health-care-reform-risk-adjustment-reinsurance-and-risk-corridors/ [https://perma.cc/Y4SK-YMGW].

349. *See id.* at 6.

million per policy.[350] Congress believed that additional public protection against that risk would be needed.[351] To provide that protection, the Price-Anderson Act established a $500 million second-loss indemnity pool.[352]

Of the above precedents, a pandemic insurance risk-sharing scheme would be most analogous to sharing risk for nuclear reactor accidents if—as insurers provided for nuclear-reactor-accident coverage[353]—the private sector was willing to provide some level of first-risk pandemic liability coverage.[354] (In the case of pandemic liability coverage, this Article's vision of the private sector would include not only insurers but also capital market investors in PCAT bonds.) The government then could provide second-loss protection above the risk not covered by the private sector. Ultimately, however, whether the private sector would be willing to provide a meaningful level of first-risk pandemic coverage is an empirical question.[355] Absent that willingness, the government may need to consider sharing in the risk *pari passu*, or possibly even on a first-loss basis to induce sufficient private sector coverage.[356]

As a fallback to purchasing PCAT bonds to make up the capital-market-investment shortfall, the government might consider guaranteeing the PCAT bonds to the extent necessary to motivate capital market investors to purchase all of the bonds, thereby obviating a shortfall. Government risk-

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350.   *Government Indemnity and Reactor Safety*, *Hearing on S. 715 and H.R. 1981 Before the Joint Comm. on Atomic Energy*, 85th Cong. 9 (1957) (statement of Lewis L. Strauss, Chairman, Comm. on Atomic Energy).

351.   *See id. Cf. Liability for Nuclear Damage*, WORLD NUCLEAR INST. https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/liability-for-nuclear-damage.aspx [https://perma.cc/E4RS-LJBV] (detailing how the Price-Anderson Act now requires at least $450 million in liability coverage for each nuclear reactor).

352.   *See supra* note 330 and accompanying text.

353.   *See supra* note 277 and accompanying text.

354.   *Cf.*, ORG. FOR ECON. CO-OPERATION & DEV., RESPONDING TO THE COVID-19 AND PANDEMIC PROTECTION GAP IN INSURANCE 11 (2021), https://www.oecd.org/coronavirus/policy-responses/responding-to-the-covid-19-and-pandemic-protection-gap-in-insurance-35e74736/ [https://perma.cc/K7VW-RAEL] ("There may be limited private sector appetite for pandemic risk.").

355.   Indeed, the level of government risk-sharing would generally affect the amount of capital market investment. Private investors would prefer, in order, that the government engage in first-loss, *pari passu*, and second-loss risk-sharing. First-loss government risk-sharing, for example, would create a senior-subordinated structure as between capital market investors and the government, with the government holding the subordinated bonds. *Cf. supra* Section II.A.4 (describing such a structure as between senior and subordinated capital-market-investors).

356.   The Chubb proposal includes government risk-sharing, but it is somewhat ambiguous as to the priority of risk that the federal government would take on for each "layer" of risk. *See supra* note 301 (proposing that the federal government cover, for small businesses, at least 88% of the first $250 billion layer of losses and all of the next $500 billion layer of losses; and, for large and medium businesses, that the federal government cover $400 billion of losses less the losses covered by private insurers, which would be limited to $15 billion in the first year and $30 billion by year 10 of the program); *supra* notes 340–341 and accompanying text (further explaining that risk-sharing). That appears to suggest that the federal government shares *pari passu* for its 88% of the $250 billion layer, on a second-loss basis up to $500 billion for the $750 billion of small-business coverage, and on a second-loss basis for the $400 billion layer.

sharing through a guarantee might be more politically acceptable because it would not require an initial outflow of funds. Risk-sharing under the Price-Anderson Act, for example, effectively took the form of a federal government guarantee.[357] A guarantee might also be more politically acceptable because guarantors are influenced by abstraction bias, a type of cognitive bias. Unlike investors, they do not actually transfer their property at the time they make a guarantee. This can cause them to view their risk-taking more abstractly and to underestimate the risk, even after discounting for the fact that payment on a guarantee is a contingent obligation.[358]

In addition to the guarantee provided under the Price-Anderson Act, there is significant precedent for the federal government to offer guarantees in order to facilitate socially important projects. For example, the federal government routinely guarantees overseas investments that advance U.S. security and foreign policy through the Overseas Private Investment Corporation (OPIC), a federal agency recently "transformed" into the U.S. International Development Finance Corporation (DFC), which styles itself as "America's development bank."[359]

Because any government guarantee of PCAT bonds would be tailored to motivate private investment, it would not necessarily need to be a full guarantee of those bonds. A partial guarantee—for example, covering only a set percentage (such as the first 10%) of losses on each bond[360]—might be sufficient to provide that motivation.[361] This could become complicated,

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357. *See supra* note 330 and accompanying text (explaining that the government $500 million of protection for nuclear-reactor accident risk would be payable only on the contingency that the industry-provided $60 million first-loss position would become depleted).

358. *See* Schwarcz, *Regulating Financial Guarantors*, *supra* note 285, at 170–73 (discussing abstraction bias and providing empirical evidence that it is real and can influence even sophisticated financial guarantors).

359. *See Who We Are*, U.S. INT'L DEV. FIN. CORP., https://www.dfc.gov/who-we-are [https://perma.cc/YW84-KDJL].

360. *Cf.* Richard Cantor, Kenneth Emery & Pamela Stump, *Rating Methodology: Probability of Default Ratings and Loss Given Default Assessments for Non-Financial Speculative-Grade Corporate Obligors in the United States and Canada*, MOODY'S 6 (Aug. 2006), https://care-mendoza.nd.edu/assets/152347/loss-given-default-rating-methodology.pdf [https://perma.cc/GUV7-6ZAD] (discussing rating-agency assessment of loss severity on corporate bonds). *But cf.* Rebecca Lake, *How Does an SBA 7(a) Loan Work?*, U.S. NEWS & WORLD REP. (Oct. 2, 2019, 9:57 AM), https://loans.usnews.com/articles/how-does-an-sba-7a-loan-work (reporting that the U.S. Small Business Administration provides partial guarantees of up to 75-85% to encourage small business loans). Partial guarantees might, as suggested in the text above, cover an investor's first losses up to the set percentage limit, or they might share in those losses *pari passu* up to that set limit. *Cf. supra* notes 311–314 and accompanying text (analyzing the several possible priorities of government risk-sharing).

361. Partial guarantees are common for debt claims because an obligor's default on its debt does not normally result in its failure to pay all of that debt. *See supra* note 360 (discussing rating agency assessments of loss severity). *Cf. Govt Eases Norms of Partial Credit Guarantee Scheme to Help NBFCs, HFCs*, ECON. TIMES (May 20, 2020, 5:45 PM), https://economictimes.indiatimes.com/news/economy/policy/govt-eases-norms-of-partial-credit-guarantee-scheme-to-help-nbfcs-hfcs/articleshow/75848244.cms?from=mdr [https://perma.cc/9LMS-S9FJ?type=image] (reporting that during the COVID-19 pandemic, India provided partial guarantees of

however, for parametric insurance.[362] Recall that parametric insurance does not indemnify the actual loss but, instead, pays a pre-set amount upon the occurrence of the triggering event.[363] To motivate private investment, any partial guarantee should be calibrated to the pre-set amounts and their triggering events. If, for example, the parametric insurance paid only $115 billion (that is, $10% of $1.150 trillion) for the occurrence of a flu pandemic that, statistically, was shown to be the only pandemic likely to occur during the term of the insurance, investors might well be attracted by a 10% partial government guarantee of their bonds. A government guarantee also could be time limited, falling away after a specified period such as two or three years. That would help to address possible investor concerns about a second-wave COVID pandemic.[364] In other contexts, short-term government guarantees have proved successful in strengthening investor confidence.[365]

D. Cost-Benefit Analysis

Although cost-benefit analysis "has a variety of meanings and uses,"[366] its traditional and common use is to assess the desirability of proposed regulation,[367] focusing on whether the benefits of implementing that

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up to 20% of first losses to banks that purchased bonds and other notes of non-banking financial companies).

362. *See supra* notes 97–99 and accompanying text (discussing parametric insurance).

363. *See supra* notes 100–102 and accompanying text.

364. *See, e.g.*, Camilla Hodgson, Ben Hall & Hudson Lockett, *Markets Fall on Fears of Second Wave of Covid Infections*, FIN. TIMES (Sep. 21, 2020), https://www.ft.com/content/3f4fcb0f-0895-4abc-a12c-97489e9786c2. Alternatively, the guarantee could be given by a government-sponsored SPV. Used in other public-private partnerships, this strategy would allow the government to keep the liability off its balance sheet (thereby, not subtracting from the government's borrowing authority and potentially protecting the credit rating on full-recourse government bonds). TRAVELERS INS., PUBLIC PRIVATE PARTNERSHIPS AND THE PRIVATE FINANCE INITIATIVE IN THE UNITED STATES 1, 3, https://suretybonds-california.com/wp-content/uploads/Private-Public-Partnerships.pdf. [https://perma.cc/8SQG-45X2].

365. *Cf.* Giuseppe Grande, Aviram Levy, Fabio Panetta & Andrea Zaghini, *Public Guarantees on Bank Bonds*, 2011 OECD J.: FIN. MKT. TRENDS 1, 3, 8 (reporting that in the wake of the global financial crisis, a number of countries, including the United States, the United Kingdom, and France, provided government guarantees to comfort investors about the risk of default on bank fixed-income debt and other non-cash deposit-based liabilities; these guarantees so successfully strengthened investor confidence that they were able to be discontinued after a few years).

366. RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 396 (6th ed. 2003).

367. *See, e.g.*, *Cost-Benefit Analysis*, BLACK'S LAW DICTIONARY (10th ed. 2014) (defining cost-benefit analysis as "[a]n analytical technique that weighs the costs of a proposed decision"); BOUVIER LAW DICTIONARY 1151 (Stephen Michael Sheppard ed., Compact ed. 2011) (observing that federal agency cost-benefit analysis for determining whether a new regulation is promulgated "must demonstrate that the benefits to society outweigh the costs that the regulation will impose"); MAEVE P. CAREY, CONG. RSCH. SERV., R41974, COST-BENEFIT AND OTHER ANALYSIS REQUIREMENTS IN THE RULEMAKING PROCESS 1 (2014) ("Cost-benefit analysis, in [the federal rulemaking] context, involves the systematic identification of all of the costs and benefits associated with a forthcoming regulation . . . .").

regulation would exceed its costs.[368] This subsection examines whether the benefits of using risk securitization and the issuance of CAT bonds to help insure pandemic-related risks would be likely to exceed its costs.

1. Fairness of the pricing

Fairness requires the pricing of PCAT bonds to be transparent to both issuers and investors and as fully informed as possible.[369] Some might question that, however, in light of a recent study purporting to show that the pricing of CAT bonds used to insure losses caused by extreme climate events makes bond investors richer by systematically overestimating risks and artificially inflating bond returns.[370] One of the study's authors said that

> CAT bond models cannot forecast accurately extreme climate events. Their predictive power turned out to be low and is showing no sign of becoming any better over time. . . . The interesting thing is however, that market actors are entirely aware of modeling inaccuracy, yet still continue to be active in the market.[371]

At least in the context of using CAT bonds "to tackle the [UN Sustainable Development Goals] SDGs . . . to truly create social value," he suggested that CAT bonds should not, as has been customary, be issued in private placements; instead, he proposed that they be publicly issued and traded in order to create more transparency and encourage a wider investor base.[372]

This Article certainly applauds the call to increase transparency and encourage a wider investor base for CAT bonds. To that end, other things being equal, it would be desirable to publicly issue and trade PCAT bonds. Although more costly, public issuance carries the benefit of robust

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368.   *Cf.* CAREY, *supra* note 367, at 1 (observing that a "proposed regulatory requirement is judged to pass the 'cost-benefit test' if the sum of its anticipated benefits outweighs, or otherwise justifies, the sum of its present and future costs in present value terms").

369.   *See* ELIZABETH CAVA & GOKUL SUDARSANA, DELOITTE, FAIR VALUING INSURANCE-LINKED SECURITIES 1 (2018), https://www2.deloitte.com/content/dam/Deloitte/bm/Documents/about-deloitte/2017-factsheets/ARA_bm_FairValuing-InsuranceLinkedSecurities-23July2018_FINAL.pdf [https://perma.cc/88T8-ULCP].

370.   Etzion et al., *supra* note 266, at 547–48. *See also* Peter Remon, *Catastrophe Bonds Are Not Contributing to Sustainable Financial Markets*, BDAILY NEWS (Jan. 3, 2020) https://bdaily.co.uk/articles/2020/01/30/catastrophe-bonds-are-not-contributing-to-sustainable-financial-markets. The authors of this study—Bernard Forgues, Professor of Strategy at emlyon business school, in collaboration with Dror Etzion from McGill University and Emmanuel Kypraios from Maynooth University—compiled a list of all CAT bonds issued from their conception in 1996 to March 2016. In total, they established a database of 383 deals, of which they assessed the forecast accuracy. They compared that data with those of the 10 CAT bonds that have been triggered and thus caused capital losses to investors.

371.   Remon, *supra* note 370.

372.   *Id.*

disclosure, providing more information to investors.[373] However, modeling pandemic risk should be much more calculable than modeling extreme climate events.[374] The potential spread of an infectious disease into a global pandemic largely depends on network effects and government border controls.[375] Major risk-management firms, such as Metabiota, Air Worldwide, Milliman, and Risk Management Solutions (RMS), claim they can quantify pandemic risk.[376] RMS's modeling "innovation" uses a form of model spotting to anticipate the spread of coronavirus.[377] AIR Worldwide has introduced its Air Pandemic Model which claims to go "beyond traditional epidemiological modeling" by accounting for a wide array of government health interventions and human travel patterns.[378]

Admittedly, the infrequency of pandemics raises doubts about the accuracy of any such risk modeling. The AIR Worldwide model acknowledges, for example, its informational limitations.[379] The risk modeling of PCAT bonds thus may well be as fully informed as possible,[380] but not necessarily fully informed. It therefore is possible that the models overestimate or underestimate pandemic-related risk. In the former case, investors in PCAT bonds may become richer; in the latter case, they may become poorer. But that generally reflects the deal made by investors in any new product.

2. *Moral hazard*

A government requirement for businesses to purchase pandemic-risk insurance, as this Article proposes, should reduce moral hazard.[381] Absent

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373. *Cf. Investor Bulletin: Private Placements Under Regulation D*, SEC (Sept. 24, 2014), https://www.sec.gov/oiea/investor-alerts-bulletins/ib_privateplacements.html [https://perma.cc/2WU4-DKP5] (observing that "private placements are not subject to some of the laws and regulations that are designed to protect investors, such as the comprehensive disclosure requirements that apply to registered offerings").

374. *See supra* note 14 and accompanying text.

375. *See* Robert Muir-Wood, *The Coronavirus Outbreak: Part One – Modeling "Spotting,"* RISK MGMT. SOLS. (Feb. 4, 2020), https://www.rms.com/blog/2020/02/04/the-coronavirus-outbreak-part-one-modeling-spotting [https://perma.cc/83HW-SYPU].

376. *See supra* note 14 and accompanying text.

377. *See supra* note 14 and accompanying text.

378. AIR WORLDWIDE, THE AIR PANDEMIC MODEL 2 (2018), https://www.air-worldwide.com/siteassets/Publications/Brochures/documents/AIR-Pandemic-Model [https://perma.cc/44UM-EFLN].

379. *See id.*

380. *Cf. supra* note 369 and accompanying text (observing that fairness requires the pricing of PCAT bonds to be as fully informed as possible).

381. Moral hazard generally refers to "loss-increasing behavior that arises under insurance." David Rowell & Luke B. Connelly, *A History of the Term "Moral Hazard,"* 79 J. RISK & INS. 1051, 1051 (2012). Moral hazard can arise *ex ante* as when an insured engages in risky behavior or fails to take precautions because he knows any loss will be covered by insurance. *See id.* Moral hazard also can

such a requirement, businesses that otherwise view pandemic insurance as economically desirable might forgo paying for such insurance because they expect federal bailouts in the event of a major pandemic.[382]

A requirement to purchase pandemic-risk insurance should be especially beneficial because constructive ambiguity, the traditional strategy for reducing moral hazard and the expectation of government bailouts,[383] would not plausibly work for pandemics because of the resulting widespread economic devastation.[384] Constructive ambiguity refers to a deliberate effort to cultivate uncertainty as to the availability, timing, or terms of a bailout by use of imprecise or ambiguous language or policies.[385] Historically, central banks have employed constructive ambiguity by refusing to adopt any explicit policy guaranteeing bailouts for financial institutions.[386] Constructive ambiguity would not plausibly work for pandemics because, absent bailouts (or pandemic insurance), there would be widespread business failures that could devastate the economy.[387] A government is unlikely to let that happen.[388]

A requirement for businesses to purchase pandemic-risk insurance might inadvertently foster some moral hazard by making businesses less

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arise *ex post* as when an insured exaggerates her losses to receive a higher insurance payout. *See id.* at 1052.

382.   *Cf.* Veronique Bruggeman, Michael Faure & Tobias Heldt, *Insurance Against Catastrophe: Government Stimulation of Insurance Markets for Catastrophic Events*, 23 DUKE ENV'T L. & POL'Y F. 185, 208–09 (2012) (discussing the propensity for private actors to forgo insurance counting on government compensation). Furthermore, if a significant percentage of businesses fail to purchase pandemic-risk insurance, in hopes of free riding on future bailouts, risk-securitization transactions might become too small to statistically diversify pandemic-related risks.

383.   *See generally* Frederic S. Mishkin, *Financial Consolidation: Dangers and Opportunities*, 23 J. BANKING & FIN. 675, 683 (1999) (providing a general overview of constructive ambiguity as a strategy for mitigating moral hazard in the financial sector).

384.   *See* Daniel Kurt, *The Special Economic Impact of Pandemics*, INVESTOPEDIA (Aug. 25, 2021),   https://www.investopedia.com/special-economic-impact-of-pandemics-4800597 [https://perma.cc/YC8B-TGKE].

385.   *See* Dan Awrey, *The Puzzling Divergence of the Lender of Last Resort Regimes in the US and UK*, 45 J. CORP. L. 597, 614 (2020).

386.   *See generally* Mishkin, *supra* note 383, at 680–81.

387.   *Cf.* ROBERT HARTWIG, AM. PROP. CAS. INS. ASS'N, UNINSURABILITY OF MASS MARKET BUSINESS CONTINUITY RISKS FROM VIRAL PANDEMICS, 4–5 (2020) (discussing the widespread effect that a pandemic can have on mass markets). Models of the economic fallout of the COVID-19 pandemic absent government bailout suggest that had the U.S. government not intervened, a sharp decline in macroeconomic activity would have led to skyrocketing corporate defaults, which in turn would have led to a massive increase in bank failures. *See, e.g.*, Vadim Elenev, Tim Landvoigt & Stijn Van Nieuwerburgh, *Can the Covid Bailouts Save the Economy?* 25 (Nat'l Bureau of Econ. Rsch., Working Paper No. 27207, 2020), https://www.nber.org/papers/w27207 [https://perma.cc/EK4U-84GL].

388.   *Cf.* Alison M. Hashmall, *After the Fall: A New Framework to Regulate "Too Big to Fail" Non-Bank Financial Institutions*, 85 N.Y.U. L. REV. 829, 843–45 (2010) (arguing that for a policy of constructive ambiguity to be at all successful, it must be possible for businesses to fail without causing a financial crisis). Many believe that the U.S. government's failure to bail out Lehman Brothers, then the fourth largest investment bank, caused the panic that triggered the global financial crisis, and that the government would be reluctant to take similar future risks. *See id.* at 839.

motivated to take the proper precautions to halt the spread of the disease. Virtually all insurance, however, creates this type of inadvertent moral hazard risk, which the industry controls by setting appropriate deductibles.[389] Pandemic-risk insurance likewise should be subject to a deductible. Uncertainty over whether a business's pandemic insurance will be high enough to cover all pandemic-related losses also should help to control this moral hazard.[390]

The requirement for businesses to purchase pandemic-risk insurance might also inadvertently foster governmental moral hazard by making governments less likely to mandate protections. For example, a government might be less likely to issue politically difficult stay-at-home orders, to require residents to wear face masks, or to close borders. A government might even have an incentive to let a pandemic worsen to trigger insurance payouts. The World Bank's PEF insurance mitigates governmental moral hazard by having the cash window make funds accessible for countries combating pandemics that are not yet sufficiently severe to trigger the insurance window.[391] Governmental moral hazard is also limited by the significant backlash that a government could face by mishandling an epidemic.[392]

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389.   Car insurance deductibles provide a familiar example. If a driver purchases comprehensive car insurance and has no deductible, he has relatively little reason to drive carefully because any damage resulting from an accident will totally covered by the insurance company. However, if the insurance policy has a $2,000 deductible, then the driver will have to pay for a portion of his car accidents and is thereby incentivized to drive more carefully. The deductible realigns the interests of the driver and the insurance company and therefore mitigates moral hazard. *See* Andrew Beattie, *What is a Moral Hazard?*, INVESTOPEDIA,   https://www.investopedia.com/ask/answers/09/moral-hazard.asp [https://perma.cc/6CJS-NADE].

390.   Pandemic costs can be huge. Some estimate, for example, that the long-term economic impact of COVID-19 could be as high as $15.7 trillion dollars. Letter from Phillip L. Swagel, Dir., Congr. Budget Off., to Charles E. Schumer, Sen. Minority Leader, U.S. Senate, Comparison of CBO's May 2020 Interim Projections of Gross Domestic Product and Its January 2020 Baseline Projections, 2 (June 1, 2020), https://www.cbo.gov/system/files/2020-06/56376-GDP.pdf [https://perma.cc/88SE-VRKN]. The risk of illness or death provides another brake on moral hazard; businesses should have an incentive to make their workplaces safe for their employees and customers. *Cf. Cases in the U.S.*, CTR. DISEASE CONTROL & PREVENTION, https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html [https://perma.cc/7SHC-FXD9] (discussing the risk of illness or death).

391.   PANDEMIC EMERGENCY FINANCING FACILITY (PEF), *supra* note 102, at 5.

392.   *Cf.* Justin Sink, *President Obama's Ebola Problem*, THE HILL (Oct. 16, 2014, 6:00 AM), https://thehill.com/news/administration/220922-president-obamas-ebola-problem [https://perma.cc/CA82-QLTR] (criticizing the Obama administration for its alleged mishandling of the Ebola outbreak in West Africa); Jessie Hellmann, *Trump Downplaying Sparks New Criticism of COVID-19 Response*, THE HILL (July 6, 2020, 4:13 PM), https://thehill.com/policy/healthcare/506075-trump-downplaying-sparks-new-criticism-of-covid-19-response [https://perma.cc/HH29-MDAV] (criticizing the Trump administration for its mishandling of COVID-19).

3. *Possible unintended consequences*

Although no article can predict all unintended consequences, one such potential consequence is that the occurrence of a pandemic could jeopardize the solvency of systemically important financial institutions that invest heavily in PCAT bonds. This potential consequence parallels the concern that post-global-financial-crisis regulation requiring systemically important financial institutions (SIFIs) to issue a portion of their debt as contingent-convertible (CoCo) bonds might jeopardize the solvency of investors in those bonds.[393] CoCo bonds are intended to convert from debt claims to equity interests if the issuer faces certain financial problems.[394] That conversion would significantly reduce the value of those bonds as investments, thereby reducing the asset value of investors—who may themselves be SIFIs.[395] A possible way to minimize SIFI conversion risk is to limit the amount of CoCo bonds that any given SIFI could hold.[396] That same approach—limiting the amount of PCAT bonds that any given SIFI could hold—should similarly help to mitigate this concern.

4. Ex ante *versus* ex post *pandemic preparation*

Using risk securitization and the issuance of CAT bonds to help insure pandemic-related risks would be an *ex ante* approach to controlling pandemic costs. Some have asked whether the cost-benefit balancing of that approach would be more optimal than addressing pandemics *ex post*, as and when they occur.[397] After all, it has been over 100 years since the Spanish Flu—the last pandemic[398] with the severe impact of COVID-19—occurred, and it may be another century or so until the next one occurs.

That question, however, is inapposite because this Article does not suggest that its *ex ante* proposal should obviate the need for *ex post* responses. To the contrary, the Article cautions that risk securitization is not a panacea. We do not yet know enough about pandemic-related risk to design perfect *ex ante* protections.[399] For example, pre COVID-19,

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393. *See infra* note 397.

394. *See* Steven L. Schwarcz, *Systematic Regulation of Systemic Risk*, 2019 WIS. L. REV. 1, 9.

395. *See id.*

396. *See id.* at 9–10.

397. *Cf.* Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557, 568–71 (1992) (asking whether social welfare is maximized through the promulgation of *ex ante* or *ex post* approaches, and describing the social objectives of law to be the maximization of benefits net of costs).

398. *1918 Pandemic (H1N1 virus)*, CTR. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/flu/pandemic-resources/1918-pandemic-h1n1.html [https://perma.cc/36Q7-4BUF].

399. *Cf.* Michael T. Osterholm & Mark Olshaker, *Why We Are So Ill-Prepared for a Possible Pandemic Like Coronavirus*, TIME (Feb. 5, 2020, 9:52 AM), https://time.com/5777923/america-prepared-pandemic-coronavirus/ [https://perma.cc/2GMY-MSJB] (observing that despite explicit

nationwide and subnational shutdowns and shelter-in-place orders on a massive scale, and their accompanying economic impacts, were largely unheard of.[400] Future pandemics could also raise economic and other challenges that only become apparent *ex post*.[401] Lacking the ability to prevent future pandemics, *ex ante* approaches to controlling pandemics must be coupled with *ex post* approaches that take into account the insights gained by responding once more information becomes known.[402] This strategy also takes inspiration from chaos theory, which holds that in complex systems where failures are inevitable,[403] remedies should also focus on breaking the transmission of these failures and limiting their harmful consequences.[404]

Furthermore, the public cost of using risk securitization and the issuance of CAT bonds to help insure pandemic-related risks should be relatively small compared to the cost of dealing with a full-blown pandemic. This Article contemplates federal government risk-sharing of hundreds of billions of dollars.[405] That is much lower than the federal government's current COVID-19 related costs, estimated at over $6 trillion.[406]

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warnings that the world was ill-equipped to respond to a severe pandemic, governments and private businesses alike were caught off guard by the global emergence of COVID-19).

400. Kaleigh Rogers, *Why Did the World Shut Down for Covid-19 but Not Ebola, SARS or Swine Flu?*, FIVETHIRTYEIGHT (Apr. 14, 2020, 7:00 AM), https://fivethirtyeight.com/features/why-did-the-world-shut-down-for-covid-19-but-not-ebola-sars-or-swine-flu/ (noting that other infectious diseases did not warrant a shut-down).

401. *See generally* Wan-Lae Cheng, André Dua, Zoe Jacobs, Mike Kerlin, Jonathan Law, Ben Safran, Jörg Schubert, Chun Ying Wang, Qi Xu & Ammanuel Zegeye, *Reimagining the Post-Pandemic Economic Future*, MCKINSEY & CO. (Aug. 14, 2020), https://www.mckinsey.com/industries/public-and-social-sector/our-insights/reimagining-the-postpandemic-economic-future [https://perma.cc/D29N-HCRT].

402. *Cf.* Iman Anabtawi & Steven L. Schwarcz, *Regulating* Ex Post*: How Law Can Address the Inevitability of Financial Failure*, 92 TEX. L. REV. 75 (2013) (arguing that effective regulatory regimes should rely on a combination of *ex ante* and *ex post* approaches). Also, *ex ante* approaches may not even respond to the potential severity of future pandemics because, as time passes, memories of past pandemics tend to fade. *See* Sean Donahue, *As Collective Memory Fades, So Will Our Ability to Prepare for the Next Pandemic*, CONVERSATION (May 20, 2020, 8:10 AM), https://theconversation.com/as-collective-memory-fades-so-will-our-ability-to-prepare-for-the-next-pandemic-137370 [https://perma.cc/9WW5-ZMTU].

403. *See* Steven L. Schwarcz, *Regulating Complexity in Financial Markets*, 87 WASH. U. L. REV. 211, 248–49 (2009). One aspect of chaos theory is deterministic chaos in dynamic systems, which recognizes that the more complex the system, the more likely it is that failures will occur. Thus, the most successful (complex) systems are those in which the consequences of failures are limited. In engineering design, for example, this can be done by decoupling systems through modularity that helps to reduce a chance that a failure in one part of the system will systemically trigger a failure in another part. See *id.*

404. *See id. Cf.* COMM'N ON A GLOB. HEALTH RISK FRAMEWORK FOR THE FUTURE, NAT'L ACAD. OF MED., SECRETARIAT, THE NEGLECTED DIMENSION OF GLOBAL SECURITY: A FRAMEWORK TO COUNTER INFECTIOUS DISEASE CRISES 19 (2016) (observing "there is a powerful case for investing more to minimize the frequency and mitigate the impact of potential pandemics").

405. *See supra* notes 299–308 and accompanying text.

406. *See, e.g.*, Andrew Van Dam, *The U.S. Has Thrown More Than $6 Trillion at the Coronavirus Crisis. That Number Could Grow*, WASH. POST (Apr. 2020), https://www.washingtonpost.com/business/2020/04/15/coronavirus-economy-6-trillion/

For these reasons, the benefits of using risk securitization and the issuance of CAT bonds to help insure pandemic-related risks would be likely to exceed its costs.[407]

CONCLUSION

Governments could protect against the potential economic devastation of future pandemics by requiring businesses to insure against pandemic-related risks. There appear to be sufficient statistical data to reliably set insurance-underwriting standards. By definition, however, pandemic risks occur worldwide and are highly correlated. They therefore are in the class of risks, like war, terrorism, and riots, that are considered uninsurable because they are beyond the capacity of private insurers. The occurrence of one or more pandemics could create losses that would overwhelm the insurance markets.

Risk securitization—an innovative private-sector alternative to government insurance, funded by the issuance of CAT bonds—could help to insure pandemic-related risks. By utilizing the deep pockets of the global capital markets, risk securitization greatly expands the capacity to absorb these risks. A scaled-back pilot project that provides limited pandemic-risk coverage, such as the World Bank's recent pilot project to provide limited pandemic insurance in developing countries, could test the risk-securitization concept.

Risk securitization also raises novel legal and economic challenges. Certain of these challenges parallel but are more complex than those arising in structuring traditional securitization transactions. Other challenges involve issues of first impression, including the extent to which risk securitization should be regulated as a form of reinsurance, the constitutionality of requiring that businesses purchase pandemic insurance, and the legality and relative prioritization of public-private risk sharing between governments and CAT bond investors.

[https://perma.cc/4M2K-KG3P]. While certainly some of that money, such as additional funding for testing, contact tracing, and PPE equipment, would have to be spent regardless, it only accounts for about $565 billion of that total. *See Covid Money Tracker*, COMM. RESPONSIBLE FED. BUDGET, https://www.covidmoneytracker.org/ [https://perma.cc/N74L-P7RP].

407.   Even absent that conclusion, this Article's cost-benefit analysis should consider the possibility of taking into account a precautionary principle because the occurrence of a pandemic could have massively harmful consequences. Precautionary principles generally direct "regulators to err on the side of regulating an activity when the outcome of that activity is uncertain, but potentially irreversible and catastrophic." Hilary J. Allen, *A New Philosophy for Financial Stability Regulation*, 45 LOY. U. CHI. L.J. 173, 191 (2013). Although precautionary principles have different forms, its semi-strong form, which is applied to "activities [that] can pose great harm," appears most applicable to protecting against pandemics. *Id.* at 195. Under this principle, "precautionary regulation should be employed that effectively shifts the burden to prove that the activity should be permitted to the proponent of that activity, rather than forcing the regulator to make the case for why regulation is necessary." *Id.*

The theoretical import of this Article's analysis goes beyond pandemic insurance to insuring against terrorism, riots, and other risks that exceed the capacity of private insurers. Risk securitization could similarly expand the insurance industry's capacity to absorb these risks, provided there are adequate actuarial data. Investors should want to purchase CAT bonds covering these risks because they are not ordinarily correlated with standard economic risks. Although there is a loose correlation insofar as terrorism and riots could cause an economic decline, CAT bond investors explicitly would bargain to take those risks.[408] Distinguishing correlation from causation, the important point for CAT bond investors is that an economic decline that could impair the value of their traditional investment portfolios would not ordinarily cause terrorism or riots that could impair the value of their CAT bond investment portfolios.

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408.   For CAT bonds covering the risks of terrorism or riots, the investors in those bonds would subordinate their right to repayment of their bonds to the indemnification rights of the primary insurers. *Cf. supra* notes 56–58 and accompanying text (explaining this in the context of CAT bonds covering pandemic risk).