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NYT: Preparing for Disaster by Betting Against It.

At 2 a.m. on Oct. 29, 2012, the Metropolitan Transportation Authority (M.T.A.) shut down the New York City subway system in preparation for Hurricane Sandy. By 9 p.m. storm surges reached nearly 14 feet at Manhattan's Battery, as the waves of the East and Hudson Rivers deluged the city's rail stations and tunnels, flooding tracks, corroding antiquated electric controls and wreaking \$5 billion in damage on the largest regional transportation provider in the Western Hemisphere. As it emerged from Sandy's wreckage, the M.T.A. found it impossible to buy any existing kind of insurance against future storms.

Not for the first time in New York City, necessity has bred an interesting kind of financial invention. In the wake of Sandy, the M.T.A. worked with the First Mutual Transportation Assurance Company (F.M.T.A.C.), its "captive" (or in-house) insurer to obtain reinsurance — that is, insurance for the insurer — by issuing the world's first "catastrophe" bond designed specifically to protect against storm surge. With extreme weather becoming routine and public resources stretched thin, governments across the world — particularly at the local (and sea) level — are taking note.

In the wake of the 2008 economic crash, the bailout of many of our major financial institutions socialized (absorbed with tax payer money) the risks — and bad bets — taken by private investors with "financial innovations" like credit default swaps. When it comes to natural disasters, we are increasingly accustomed to the same: government's covering a large share of private losses. Recently, however, and notably at the local level, we have observed the emergence of new kinds of financial innovations that do the reverse. They seek to bring public needs to the private markets: to privatize risk for public gain. The M.T.A.'s catastrophe bond is the latest in this series of creative public finance instruments.

Catastrophe ("cat") bonds are not entirely new, though the market for them has grown substantially in the last few years. They were first explored after 1992 when Hurricane Andrew decimated parts of Florida, and with them the ability of insurance and reinsurance companies to cover their losses: more than 10 insurance companies went bankrupt trying to cover \$15 billion in damage. As the frequency and intensity of these storms increased, often striking places that were well developed and thus vulnerable to billions of dollars in damage, it was clear that traditional insurance instruments were no longer adequate. In response, reinsurance companies turned to the capital markets to help mitigate risk.

Since 1994, when Hanover Re created the first successful cat bond, approximately 230 have been issued to investors. Although most cat bonds focus on things like hurricanes in the United States (approximately 70 percent of the total market), insurers soon realized that cat bonds could be a useful way to cede or transfer risk off their balance sheets for a range of natural disasters, from earthquakes in California and Japan to windstorms in Europe and "extreme mortality" resulting from things like pandemics. Recently, there has been discussion by insurers and policy makers about the ways in which cat bonds might play a greater role in covering man-made perils like a terrorist attack.

The theory of the cat bond is relatively simple: insurers transfer their risk to capital market investors

who are betting against catastrophe; that a hurricane or an earthquake won't hit a particular place in a specified period of time. If this proves true, investors are repaid principal plus relatively high interest. If disaster strikes, however, the cat bond investors are on the hook and lose their principal. In practice, the bonds have a number of complex parts. They typically require the creation of a special purpose reinsurance entity. They are also structured around sophisticated modeling of the risk of catastrophe, which must occur at a specific "event level" (i.e., intensity of wind gust, magnitude of earthquake), geographic area and time period to "trigger" a payout.

In New York, the M.T.A. and F.M.T.A.C. worked with GC Securities and Goldman Sachs to create MetroCat Re, a reinsurer that could collateralize the reinsurance coverage it provided to F.M.T.A.C. by selling \$200 million in cat bonds to 20 investors, each betting that the city would be safe from Sandy-level storm surges for the next three years. They are probably right; Risk Management Solutions, the firm that assessed the risk, calculates that there is only a 1.67 percent chance of this kind of storm surge each year.

There are a number of innovative firsts in the M.T.A. deal. It is the first cat bond specifically designed to protect public transportation infrastructure; to date, much of the cat bond market has grown up around coverage of private property. It is also the first where the payout trigger is solely linked to storm surge levels. This means investors in the MetroCat Re cat bond pay only if coastal waters rise above 8.5 feet in the Battery, Sandy Hook and the Rockaways (where much of the damage to the subway system from Sandy occurred) or higher than 15.5 feet in East Creek and Kings Point. If there are no such storm surges before August 2016, they get their principal investment and returns of 4.5 percent annually above Treasury rates.

These kinds of yields help explain why the MetroCat Re placement was oversubscribed — and why the cat bond market has grown exponentially: over \$40 billion has been issued in the last decade, and there is now approximately \$20 billion outstanding, up from \$4 billion in 2004. In addition to the returns, institutional investors like cat bonds as a way to diversify; natural catastrophes are not correlated with other economic conditions (or the stock market).

While cat bonds are compelling for investors, do they make for good public policy? In theory, and at the federal level, the vast resources of the United States government should allow for self-insurance, absorbing the risk of catastrophe without paying a premium for coverage in the private markets. Typically, however, natural disasters strike locally, and in practice state and city governments are on the hook for much of the immediate response and rebuilding. Last month Governor Andrew M. Cuomo unveiled a plan to invest billions of dollars of federal disaster aid to improve New York's infrastructure to withstand future shocks.

Yet strengthening resilience is not just about building better or smarter; it is about how these investments are financed. The M.T.A., in the face of significantly increased prices in the traditional reinsurance market, found an inventive way to target the specific and costliest sources of property damage, the surge. "This is now an important risk financing tool for us," said Laureen Coyne, the director of risk and insurance management at the M.T.A., where the team spent three months designing the cat bond's risk assessment and pricing. Although tailored to the specific needs of the transportation assets of the MTA (and small relative to the total magnitude of Sandy's destruction), it is possible that this kind of tool may lend itself to other vulnerable municipalities. And there are more than a few. By some estimates, 90 percent of the world's cities have developed along waterways (lake, rivers, oceans) and are prone to flood. Those along a coast, like New York, are also exposed to wind-induced storm surge.

To date, most cat bonds have been issued to protect against disasters in developed economies with mature insurance markets, where the probabilities and potential losses associated with hurricanes

and earthquakes can be reasonably well modeled and political risk is low. But increasingly, developing countries are hopeful that cat bonds might help bring much-needed private sector investors to help absorb some of the risk from natural disasters. In these cases, cat bonds also serve as important tools for economic development, the rationale underpinning the World Bank's MultiCat program, created in 2009 to help member countries enter the cat bond market. Through this initiative, Mexico issued cat bonds in 2009 and 2012 to protect against earthquakes and hurricanes. In April 2013 the government in Turkey placed a \$400 million cat bond for earthquake protection.

Only a handful of the 230 or so cat bonds sold have generated a payout following a natural disaster, including Hurricane Katrina in 2005 and the earthquake and tsunami in Japan in 2011. Payouts are infrequent because the parameters used to measure the risk — location, time period, specific intensity of the event — are so narrowly defined. Notably, a hurricane the scale of Katrina prompted only one of nine cat bonds in the gulf region. Even so, the increased frequency and intensity of storms have only whet the appetite for the instruments on the reinsurance side. Though expensive, they sometimes prove to be the most cost-effective coverage in the aftermath of a catastrophe, when traditional insurance prices spike — as the M.T.A. discovered post-Sandy. Investors, particularly those seeking higher yields in a period of low interest rates, seem to believe the returns are commensurate with the risk. Then again, as Governor Cuomo observed, "The new reality in New York is we are getting hit by 100-year storms every couple of years."

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