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ECONOMIC VIEWPOINT

By Robert J. Barro



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What Price Catastrophe Risk?

Higher expectations of global conflict keep Treasury rates low

Hurricane Katrina and last December's Indian Ocean tsunami demonstrate the potentially huge social and economic consequences of rare natural disasters. But in the 20th century, the world's largest economic disasters were man-made, rather than natural, occurrences: the Great Depression of the 1930s and World Wars I and II. Although these economic catastrophes occur infrequently, worries about their prospects matter every day for financial markets.

In my research, I define an economic disaster for a single country as a collapse of gross domestic product by at least 15% over a short period. Only 2 of 20 advanced economies with available data (Norway and Switzerland) avoided having at least one such disaster in the 20th century. Although the U.S. fared well economically during World War II, 9 of the 20 had major contractions -- declines in real per capita GDP ranged between 45% and 64% for Austria, France, Germany, Greece, Italy, Japan, and the Netherlands. During World War I, eight had contractions of 15% to 35%, and another eight (including the U.S.) had similar shortfalls during the Depression.

AN ALLOWANCE FOR varying probabilities of disaster events may explain a lot of riddles in the study of finance, including the famous "equity premium" puzzle defined in an article by Rajnish Mehra and Edward C. Prescott in the 1985 *Journal of Monetary Economics*. The two noted that the U.S. and other major countries had spreads between the average returns on stocks and short-term government bills of some seven percentage points per year. The size of this spread was hard to explain in standard economic models. But especially perplexing was why real interest rates on relatively safe assets, such as U.S. Treasury bills and high-grade commercial paper, were so low, averaging only 1.5% a year since 1880.

In an article only three years after the Mehra-Prescott paper, University of Iowa economist Thomas Rietz argued that the high equity premium and the low risk-free real interest rate could be explained by fears of low-probability disaster events, such as a depression. People are risk-averse and try to protect themselves against a collapse of stocks in bad economic times. My analysis suggests that the Rietz thesis explains not only the high equity premium and low risk-free rate but also several other conundrums, including the volatility of stock prices.

In my version of Rietz's theory, the average equity premium and risk-free rate can be accounted for if there's something like a 1% annual probability of a global event that cuts output by one-third to one-half -- roughly the disaster record of the 20th century. Increased demand for safe assets in response to heightened disaster probabilities during major wars also explains why U.S. real interest rates were so low during the Civil War, World Wars I and II, and the Korean War. More recently, an increase in the perceived chance of worldwide conflict may explain the sharp decline in real interest rates after September 11 and the U.S. incursions into Afghanistan and Iraq. Real interest rates on 10-year U.S. Treasury indexed bonds fell from 3% to 4% before September 11, 2001, to an average of 1.8% for 2004-05 -- and have stayed low despite the Fed's recent hikes in short rates.

The model offers other intriguing predictions. A higher disaster probability should raise the prices of hedges like far-out-of-the-money put options on the Standard & Poor's 500-stock index as well as those of precious commodities such as gold and diamonds. A recent study by Peter Kugler and Beatrice Weder of the University of Mainz explains why Swiss franc assets systematically underperformed assets denominated in nine other major currencies. They reasoned that the Swiss franc (a traditional safe haven) would appreciate in the event of a major war or depression. But since such events haven't occurred since World War II, the unused hedge premium built into the pricing of Swiss assets made them underperformers in an era of stability.

Right now, America is focused on the impact of a rare disaster called Katrina. But this event is unlikely to cost more than \$200 billion to \$300 billion. The 15% or more GDP contractions in my analysis are of a larger order of magnitude. A 15% fall in U.S. GDP amounts to \$2 trillion. I'm pretty sure that not even Washington, which is recklessly throwing cash at the Katrina relief effort, will be able to use up \$2 trillion in resources. So, it'll take a much bigger event to get a serious response from stock and bond markets.