This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. Any errors or omissions are the responsibility of the authors.
Vulnerable Growth
Tobias Adrian, Nina Boyarchenko, and Domenico Giannone
Federal Reserve Bank of New York Staff Reports, no. 794
September 2016
JEL classification: C22, E17, E37

Abstract

We study the conditional distribution of GDP growth as a function of economic and financial conditions. Deteriorating financial conditions are associated with an increase in conditional volatility and a decline in the conditional mean of GDP growth, leading to a highly skewed distribution. The lower quantiles of GDP growth exhibit strong variation as a function of financial conditions, while the upper quantiles are stable over time. Although measures of financial conditions have significant influence in forecasts of downside vulnerability, measures of economic conditions have significant predictive power only for the median of the distribution. These findings are robust both in and out of sample and to the inclusion of different measures of financial conditions. We quantify GDP vulnerability as relative entropy between the empirical conditional and unconditional distribution. We show that this measure of vulnerability is highly asymmetric: The contribution to the total relative entropy of the probability mass below the median of the conditional distribution is larger and more volatile than the contribution of the probability mass above the median. The asymmetric response of the distribution of GDP growth to financial and economic conditions—with adverse financial conditions increasing downside vulnerability of growth but not the median forecast—is challenging for standard models of the macroeconomy. We argue that the inclusion of a financial sector is crucial for generating the observed dynamics of growth vulnerability.

Keywords: Downside risk, entropy, quantile regressions

Adrian, Boyarchenko, Giannone: Federal Reserve Bank of New York (e-mails: tobias.adrian@ny.frb.org, nina.boyarchenko@ny.frb.org, domenico.giannone@ny.frb.org). The authors thank Richard Crump, Robert Engle, Eric Ghysels, James Hamilton, Lawrence Schmidt, Erik Vogt, and Jonathan Wright for helpful comments. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.