This folder contains replication files for:
Tobias Adrian, Nina Boyarchenko, and Domenico Giannone (2018):
"Vulnerable Growth," *American Economic Review*.

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The scripts contained in this folder were tested on the Mac version of MATLAB R2017a, although efforts have been made to maximize compatibility across other operating systems and versions of MATLAB.

MATLAB toolbox dependencies and dependent files:
- Optimization Toolbox
  - VulnerabilityMain.m
  - VulnerabilityOutOfSample.m
  - VulnerabilityAlternativeApproaches.m
  - VulnerabilityAlternativeOutOfSample.m
- Global Optimization Toolbox
  - VulnerabilityAlternativeApproaches.m
  - VulnerabilityAlternativeOutOfSample.m

Data files:
- DataVulnerability.xls : contains data for real GDP growth and the Federal Reserve Bank of Chicago's National Financial Conditions Index (NFCI). Downloaded from the Federal Reserve Bank of St. Louis FRED database.
- DataVulnerabilityAppendix.xls : contains data for alternative measures of financial conditions discussed in the online appendix.   *(this file contains also the data of the file above and it is easier to access)*
- DataVulnerability.mat : data from DataVulnerability.xls converted to .mat format.
- DataVulnerabilityAppendix.mat : data from DataVulnerabilityAppendix.xls converted to .mat format.

MATLAB scripts:
- VulnerabilityReadData.m : converts the data used in the main paper and online appendix from .xls to .mat format.
- VulnerabilityExploratory.m : produces charts for the descriptive analysis presented in the following figures:
  - Figure 2. Raw Data.
  - Figure 3. Quantile Regressions.
- VulnerabilityBands.m : estimates quantile regression coefficients and computes bootstrapped confidence bands, presented in the following figure: *(non sono riuscito a tradurre perfettamente)*
  - Figure 4. Estimated Quantile Regression Coefficients.
- VulnerabilityMain.m : produces charts for the main analysis presented in the following figures:
  - Figure 1. Distribution of GDP growth over time.
  - Figure 5. Predicted Distributions.
  - Figure 6. Median, Interquartile Range, and 5 Percent Quantile of the Predicted Distribution.
  - Figure 7. The Conditional Quantiles and the Skewed t-Distribution.
  - Figure 8. Probability Densities.
  - Figure 9. Growth Entropy and Expected Shortfall over Time.

- o Figure 13. Mean, Volatility, and Entropy.
- o Figure 14. Median, Interquartile Range, and 5 Percent Quantile.
- o Figure A.1. Predictive Distribution of GDP Growth: Location and Scale Parameters over Time.
- o Figure A.2. Predictive Distribution of GDP Growth: Shape and Degrees of Freedom over Time.
- o Figures A.3 and A.4. Predictive Distribution of GDP Growth: Moments over Time.
- VulnerabilityOutOfSample.m : performs an out-of-sample forecasting exercise assessing the performance of various quantile regression-based models. It produces the charts presented in the following figures:
  - o Figure 10. Out-of-Sample Predictions.
  - o Figure 11. Out-of-Sample Accuracy.
- VulnerabilityAlternativeApproaches.m : estimates conditional quantiles of GDP growth using two alternative econometric approaches (a conditionally Gaussian model and a flexible nonparametric approach) and produces charts for the following figure:
  - o Figure 12. Alternative Econometric Approaches: Predicted Distributions.
- VulnerabilityAlternativeOutOfSample.m : performs an out-of-sample forecasting exercise assessing the performance of two alternative econometric approaches (a conditionally Gaussian model and a flexible nonparametric approach) and produces charts for the following figure:
  - o Figure A.8. Out-of-Sample Performance of Alternative Approaches.
- VulnerabilityAlternativeMeasures.m : estimates quantile regression coefficients and computes bootstrapped confidence bands for alternative measures of financial conditions and NFCI subcomponents, presented in the following figures:
  - o Figure A.6. GDP Growth and Other Predictors.
  - o Figure A.7. GDP Growth and Subcomponents of NFCI.