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Empirical Estimation of GDP-at-Risk Models

CCBS Course for Central Bank of Egypt

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Plan for today

1. An introduction to data and code to construct GDP-at-Risk model

- Practical walk-through in MATLAB

2. Discussion of modelling Egyptian GDP-at-Risk

- What countries are most relevant to Egyptian macro-financial stability?
- What are the most relevant risk factors to focus on?
- Over what time span is data available for?
- Which results to focus on?

GDP-at-Risk Code: Overview

- The code is written in MATLAB and estimates a local-projection quantile regression model:

$$\underbrace{GDP\ growth}_{\text{LHS variable varies across different}}_{i,t+h} = \underbrace{\alpha_i}_{\text{Country}} + \underbrace{\beta_1 X_{i,t}}_{\text{Domestic}} + \underbrace{\beta_2 X^*_{i,t}}_{\text{Foreign}}$$

LHS variable varies across different
quantiles and horizons

Country
fixed effects

Domestic
indicators

Foreign
indicators

- The code produces:
 1. Impulse Response Functions (IRFs) at 5th, 50th, 95th perc (& mean)
 2. Quantile Response Functions (QRFs)
 3. Historical Decomposition of GDP@R

GDP-at-Risk Code: Structure

- The code folder contains a “MASTER_GAR” file which is the only code that needs to be run to load the data, estimate the QR and obtain results
- Sub-codes are labelled “GO_*” and are also contained in “mfunctions” folder
- The “MASTER_GAR” file is structured as follows:
 - Preliminaries
 - Section 1: Load in data from Excel
 - Section 2: Transform data and set-up “X” and “y” matrices for the regression
 - Section 3: Estimate quantile-regression local projection – save coefficient estimates, standard errors and fitted values
 - Section 4: Produce charts to analyse results
 - Section 5: Save estimation

GDP-at-Risk Code: User Inputs

- User inputs (% ***) in order to run MASTER_GAR:
 - Line 19: set user working directory where codes / subfolders are saved
 - Lines 24-25: select whether to save results
 - Lines 32-34: set Excel s/s names to read in data (for first run only)
 - Line 48: select model to run (defined in “GO3_Switches”)
 - Lines 106 / 117 / 124-130: select which results you want to focus on

- User inputs in GO3_Switches
 - Lines 10-16: define sample period and countries for estimation
 - Lines 18-26: set LHS variable
 - Lines 28-58 set RHS variables
 - Lines 60-65: set bootstrap options for calculation of standard errors
 - Lines 68-69: set quantiles and horizons to estimate

GDP-at-Risk Practicalities: Step 1

- Construct database and load in data
 - Data saved in Excel files and loaded into MATLAB in GO1_LoadData
 - Should include GDP data, macro-financial data, linkages data (e.g. trade/financial weights)

TODAY:

Macro-financial dataset for advanced economies from Aikman et al. (2018) (extended by Lloyd et al. (2021)): covers data on circa. 20 variables for 22 countries (AEs and EMEs) 1972-2018

GDP-at-Risk Practicalities: Step 2

- Define specification to run - sample period and choice of covariates will depend on:
 - Data availability / degrees of freedom
 - Theory / previous studies
 - Country-specific knowledge (which variables matter most for GDP-at-Risk)

TODAY:

- 1980-2018 quarterly data for 11 advanced economies
- Domestic variables: Volatility, 3y change in Credit-to-GDP, GDP growth
- Global variables: None (for now)

GDP-at-Risk Practicalities: Step 3

- Estimate QR and interpret results:
 - Are the results in line with hypothesis?
 - Do we see different effects across horizons and quantiles?

TODAY:

- Increase fin market vol. -> fall in GDP@R (*increased* tail risk) in near-term
- Increase debt-to-GDP -> fall in GDP@R (*increased* tail risk) in medium-term
- For credit, -ve effect at 5th perc = **2 x** effect at median
- Hist Decomp: at policy-relevant horizons, debt-to-GDP explains most of fluctuations in UK GDP@R

Discussion: Features of a CBE GDP-at-Risk model

- Data availability:
 - Length of time series
 - Panel vs. country-specific (is panel assumption reasonable?)
- Which risk factors?
 - Domestic financial conditions and credit growth
 - Domestic macroeconomic controls
 - Global factors?
- Results to focus on:
 - Impulse responses
 - Historical decomposition

Resources for Estimating GDP-at-Risk

Range of tools available:

- IMF (Excel / Python)
- CEMLA (R)
- BoE (MATLAB)