The effects of Macroeconomic Uncertainty on key economic and financial indicators in Cyprus

Maria Demetriadou (University of Cyprus)
Elena Andreou (University of Cyprus)
12 July 2022
UNCERTAINTY NOTIONS


“What matters for economic decision making is not whether particular economic indicators have become more or less variable but rather whether the economy has become more or less predictable; that is, less or more uncertain.”
DIFFERENT MEASURES OF (DOMESTIC AND FOREIGN) UNCERTAINTY

Jurado, Ludvigson and Ng (2015) [JLN]:
1. Domestic - large panel of Cyprus economic indicators
2. Foreign - economic variables connected with Cyprus economy

Rossi and Sekhposyan (2015) [RS] based on GDP growth:
1. Cyprus
2. Euro Area (EA).

Confidence indicators from European Commission:
1. CYESI
2. EAESI
Recent economic crises and pandemic ⇒ interest in quantifying uncertainty and studying its effects.

- JLN (US) measure: many other countries - Deutsche Bundesbank
- Economic Policy Uncertainty (news-based) estimated for a wide range of countries (Baker et al., 2016) - Bank of England
- EC country-specific and Euro Area Economic Uncertainty Indicators (2021)
MOTIVATION


- Effects **on the macroeconomy**: GDP, employment and **bank loans**.
  - Banking system in Cyprus economy and recent banking crisis
  - Bordo et al. (2016) and Valencia (2017): macroeconomic uncertainty has a significant effect on loans.

- **Domestic uncertainty** ($U_{dom}$) and **foreign uncertainty** ($U_{for}$)
  - Cyprus: small, open country
Uncertainty for $y_{jt}$ is the conditional volatility of the unforecastable part of the future value of this particular $y_{jt}$:

$$U_{jt}(h) \equiv \sqrt{E \left[ \left( y_{jt+h} - E[y_{jt+h} | I_t] \right)^2 \right] | I_t},$$

$I_t = \text{information available at time } t, j = 1, \ldots, N, t = 1, \ldots, T$

Forecastable component = common factors ($F_t$) extracted from $X_{it}$.

$$y_{jt+h} = \phi^y_j(L)y_{jt} + \gamma^F_j(L)\hat{F}_t + \gamma^W_j(L)\hat{W}_t + v^y_{jt+h} \quad (1)$$

$y_{jt} = \text{subset of } X_{it} \text{ panel (series of main interest)}, \hat{W}_t = \hat{F}_t^2$
JLN APPROACH

- Factor Augmented Vector AutoRegression (FAVAR) with $Z \sim \text{AR}(1)$ model with time-varying stochastic volatility:
  
  $$(Z_t, Y_{jt}) = \left( \begin{array}{cc} \Phi^Z & 0 \\ \Lambda_j' & \Phi^y_j \end{array} \right) (Z_{t-1}, Y_{jt-1}) + \left( \begin{array}{c} V_t^Z \\ V_{jt}^Y \end{array} \right) \iff M_{jt} = \Phi^M_j M_{jt-1} + V^M_{jt}$$

  $Z_t \equiv (Z'_t, ..., Z'_{t-q+1})'$, $Z_t \equiv (\hat{F}_t', W'_t)'$, $Y_{jt} = (y_{jt}, y_{jt-1}, ..., y_{jt-q+1})'$.

- h-period forecast error variance:
  
  $$\Omega^M_{jt} (h) = \Phi^M_j \Omega^M_{jt} (h-1) \Phi^M_j' + E_t \left( V^M_{jt+h} V^M_{jt+h}' \right)$$

- Individual uncertainty and macro uncertainty:
  
  $$\mathcal{U}^y_{jt} (h) = \sqrt{1_j \Omega^M_{jt} (h) 1_j} \quad \text{and} \quad \overline{\mathcal{U}}^y_t (h) = \frac{1}{N} \sum_{j=1}^{N} \hat{\mathcal{U}}^y_{jt} (h)$$
COVID-19: HEALTH SHOCK WITH ECONOMIC CONSEQUENCES

▪ A whole new level of uncertainty: no adjustments => post-COVID uninterpretable estimates, messing up the pre-covid fit. (Ng, 2021)


▪ Introduce restrictions and information e.g. Foroni et al. (2020), Primiceri and Tambalotti (2020), among others.

▪ We follow Ng (2021): COVID indicators to isolate COVID variations and recover estimates similar to the ones estimated pre-COVID.
COVID-19: A GENUINE UNFORECASTABLE SHOCK IN 2020Q1, BUT NOT THEREAFTER.

■ Adjustment I: Extraction of factors from the “de-COVID” data

\[
x_{it} = \begin{cases} 
  X_{it} - \mu_{0it}, & t \leq 2020Q1, \quad \mu_{0it} = \mu_{i0} = \text{mean of series } i \text{ up to } 2020Q1 \\
  X_{it} - \mu_{1it}, & t > 2020Q1, \quad \mu_{1it} = \text{estimated values of the model:} 
\end{cases}
\]

\[
X_{it} = b_0 + b_1 D_t + b_2 p_{t-1} + x_{it}
\]

\[
D_t = \begin{cases} 
  0, & t \leq 2020Q1 \\
  1, & t > 2020Q1 
\end{cases}
\]

\[
p_t = \log\left(\frac{P_t}{P_{t-1}}\right), \quad P_t = \text{Increase of positive cases}
\]

■ Adjustment II:

\[
y_{jt+h} = \varphi_j^y (L)y_{jt} + \gamma_j^F (L)\hat{F}_t + \gamma_j^W (L)\hat{W}_t + v_{jt+h}, \quad \hat{W}_t = (\hat{F}_t^2, p_t)
\]
**RS APPROACH (BASED ON GDP GROWTH)**

- Forecast error \( (e_{t+h}) = \) (Realization at \( t + h \)) – (forecasted value) \( \rightarrow p(e) = \) error distribution \( \rightarrow \) RS uncertainty \( U_{t+h} = \int_{-\infty}^{e_{t+h}} p(e)de, \in [0,1]. \)

- Positive, negative and overall uncertainty:

\[
\begin{align*}
U_{t+h}^+ &= \frac{1}{2} + \max \left\{ U_{t+h} - \frac{1}{2}, 0 \right\} \\
U_{t+h}^- &= \frac{1}{2} + \max \left\{ \frac{1}{2} - U_{t+h}, 0 \right\} \\
U_{t+h}^* &= \frac{1}{2} + \left| U_{t+h} - \frac{1}{2} \right|
\end{align*}
\]
DATA

- **JLN**: 1995Q1 – 2021Q2 ($N_{tot} = 178$ variables)
  
  i. *domestic* (country-specific) ($U_{dom}$): $N_{dom} = 129$: output, labor, interest and exchange rates, money variables, survey, prices
  
  ii. *foreign macroeconomic uncertainty* ($U_{for}$): panel of $N_{for} = 49$

- **RS**: 2003Q4 – 2021Q2 (GDP)
  
  i. **Cyprus**: up to 2016 from Consensus Economics – re-estimate: European Commission (EC), International Monetary Fund (IMF) and Central Bank of Cyprus (CBC)
  
  ii. **Euro Area**: Survey of Professional Forecasters by the European Central Bank (ECB-SPF).
DOMESTIC MACROECONOMIC UNCERTAINTY INDICES (PRE- AND POST-COVID)
DOMESTIC AND FOREIGN UNCERTAINTY MEASURES (JLN)
JLN VS RS UNCERTAINTY MEASURES

Cyprus in EU, Cyprus Referendum
9/11

Lehman
Power Supply Explosion (Māri)

Cyprus Banking Crisis
U_{RS(CY)}

U_{dom}

Brexit announcement

COVID-19
**VAR MODEL**

- **JLN-type VAR** using Cholesky lower triangular decomposition:
  \[ Y_t = A_1 + A_2 D_t + B(L)Y_t + \Gamma(L)p_t + C \eta_t \]

- **GDP** = Gross Domestic Product
- **EMP** = Employment
- **CONS** = Real Consumption
- **CPI** = Consumers Price Index
- **W** = Real Wage
- **LMPI** = Labor Market Productivity Index
- **IR** = interest rates on euro-denominated loans
- **Loans** = Loans to non-MFIs

\[ Y_t^{JLN} = \begin{pmatrix} U_{for} \\ \log(GDP) \\ \log(EMP) \\ \log(CONS) \\ \log(CPI) \\ \log(W) \\ LMPI \\ IR \\ \log(Loans) \\ \eta_t \end{pmatrix} \]
VAR IRF ANALYSIS
RS UNCERTAINTY AND CONFIDENCE INDICATORS
CONCLUSION: EMPIRICAL STUDY OF THE UNCERTAINTY IN CYPRUS

- **Econometric-based** uncertainty measures for the Cyprus economy
- **Pre-COVID literature**: increases in uncertainty lead to declines in economic activity and employment
- **Foreign uncertainty** affects local variables—more persistent effects than domestic
- Largest effect of $U_{\text{dom}}$ shocks on **loans**
- **Post-COVID literature**: importance of being aware of how the COVID-19 observations affect the existing economic models/methodologies.
THANK YOU