



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

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# UNCERTAINTY NOTIONS

1. Treat **uncertainty as risk**: Bloom (2009), Bloom (2014), Bali and Zhou (2016), Basu and Bundick (2017)
2. **Distinguish uncertainty from risk** (Knight, 1921): Jurado et al. (2015), Rossi and Sekhposyan (2015, 2017), Ludvigson et al. (2019), Carriero et al. (2018)

“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**

# MOTIVATION

- 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

- Global financial crisis – 2008, explosion of the power supply in Cyprus – 2011, banking crisis – 2013, COVID-19 – 2020.
- 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 ( $U_{for}$ )**
  - Literature: spillovers among countries, e.g. Huang et al. (2018) (US and China), Moran (2021) (Canada and US)
  - Cyprus: small, open country

# JLN APPROACH

- Uncertainty for  $y_{jt}$  is the conditional volatility of the unforecastable part of the future value of this particular  $y_{jt}$ :

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

$I_t$  = information available at time  $t$ ,  $j = 1, \dots, N$ ,  $t = 1, \dots, T$

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

$$y_{jt+h} = \varphi_j^y(L)y_{jt} + \gamma_j^F(L)\hat{F}_t + \gamma_j^W(L)\hat{W}_t + v_{jt+h}^y \quad (1)$$

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

# JLN APPROACH

- Factor Augmented Vector AutoRegression (FAVAR) with  $\mathcal{Z} \sim \mathbf{AR}(1)$  model with time-varying stochastic volatility:

$$\begin{pmatrix} \mathcal{Z}_t \\ Y_{jt} \end{pmatrix} = \begin{pmatrix} \Phi^{\mathcal{Z}} & 0 \\ \Lambda_j' & \Phi_j^y \end{pmatrix} \begin{pmatrix} \mathcal{Z}_{t-1} \\ Y_{jt-1} \end{pmatrix} + \begin{pmatrix} V_t^{\mathcal{Z}} \\ V_{jt}^y \end{pmatrix} \Leftrightarrow \mathcal{M}_{jt} = \Phi_j^{\mathcal{M}} \mathcal{M}_{jt-1} + \mathcal{V}_{jt}^{\mathcal{M}}$$

$$\mathcal{Z}_t \equiv (Z_t', \dots, Z_{t-q+1}')', \quad Z_t \equiv (\hat{F}_t', W_t')', \quad Y_{jt} = (y_{jt}, y_{jt-1}, \dots, y_{jt-q+1})'$$

- h-period forecast error variance:

$$\Omega_{jt}^{\mathcal{M}}(h) = \Phi_j^{\mathcal{M}} \Omega_{jt}^{\mathcal{M}}(h-1) \Phi_j^{\mathcal{M}'} + E_t \left( \mathcal{V}_{jt+h}^{\mathcal{M}} \mathcal{V}_{jt+h}^{\mathcal{M}'} \right)$$

- Individual uncertainty and macro uncertainty:

$$u_{jt}^y(h) = \sqrt{1_j \Omega_{jt}^{\mathcal{M}}(h) 1_j} \quad \text{and} \quad \bar{u}_t^y(h) = \frac{1}{N} \sum_{j=1}^N \hat{u}_{jt}^y(h)$$

# 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)
- Ludvigson et al. (2020): mean adjustments for US uncertainty - Moran et al. (2020) for Canadian uncertainty.
- 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

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

$$X_{it} = b_0 + b_1 D_t + b_2 p_{t-1} + x_{it}$$

$$D_t = \begin{cases} 0, & t \leq 2020Q1 \\ 1, & t > 2020Q1 \end{cases}, \quad p_t = \log\left(\frac{P_t}{P_{t-1}}\right), \quad P_t = \text{Increase of positive cases}$$

- Adjustment II:

$$y_{jt+h} = \varphi_j^y(L) y_{jt} + \gamma_j^F(L) \hat{F}_t + \gamma_j^W(L) \hat{W}_t + v_{jt+h}^y, \quad \hat{W}_t = (\hat{F}_t^2, p_t)$$

# 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:

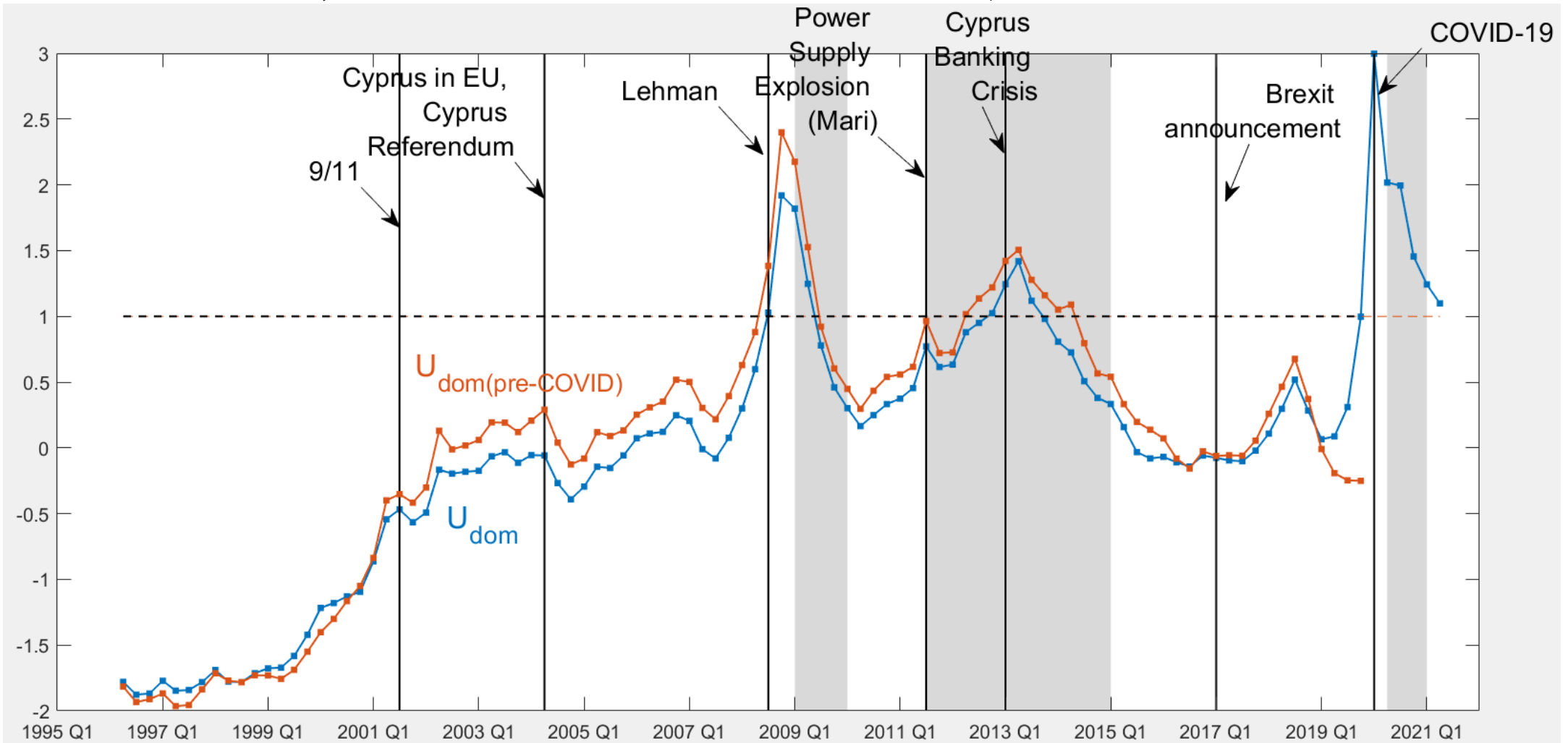
$$U_{t+h}^+ = \frac{1}{2} + \max\left\{U_{t+h} - \frac{1}{2}, 0\right\}$$
$$U_{t+h}^- = \frac{1}{2} + \max\left\{\frac{1}{2} - U_{t+h}, 0\right\}$$

$$U_{t+h}^* = \frac{1}{2} + \left|U_{t+h} - \frac{1}{2}\right|$$

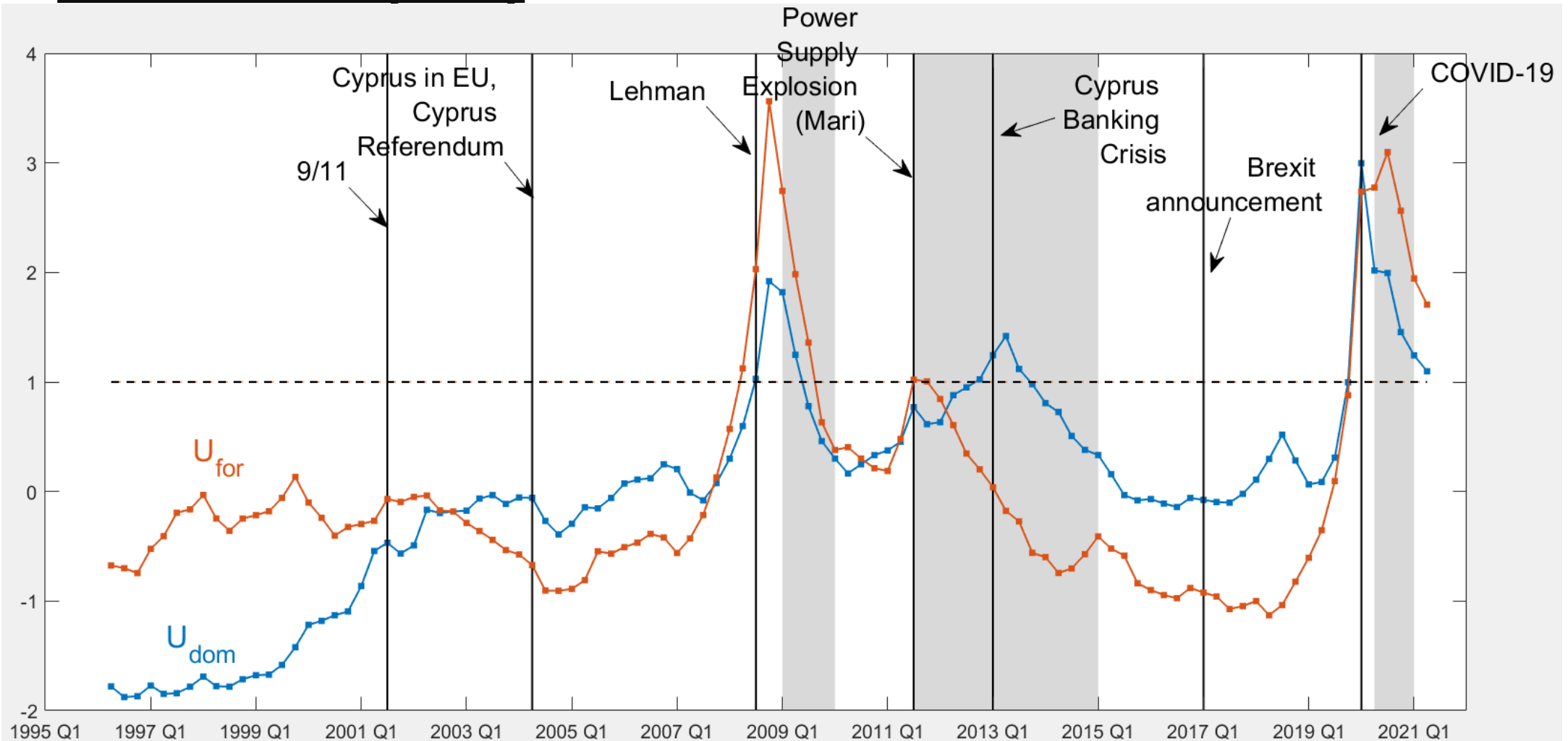
# DATA

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

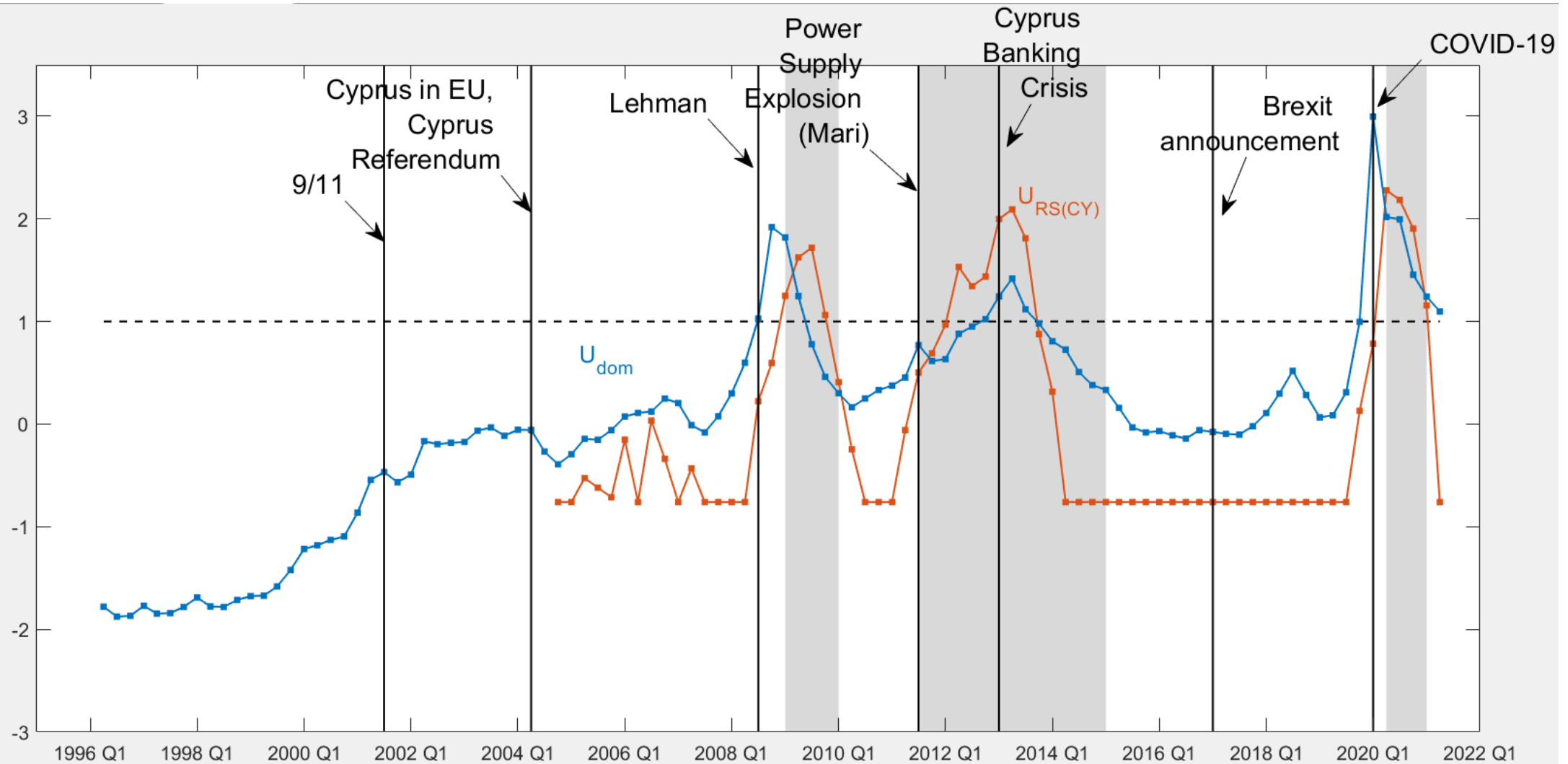
# DOMESTIC MACROECONOMIC UNCERTAINTY INDICES (PRE- AND POST-COVID)



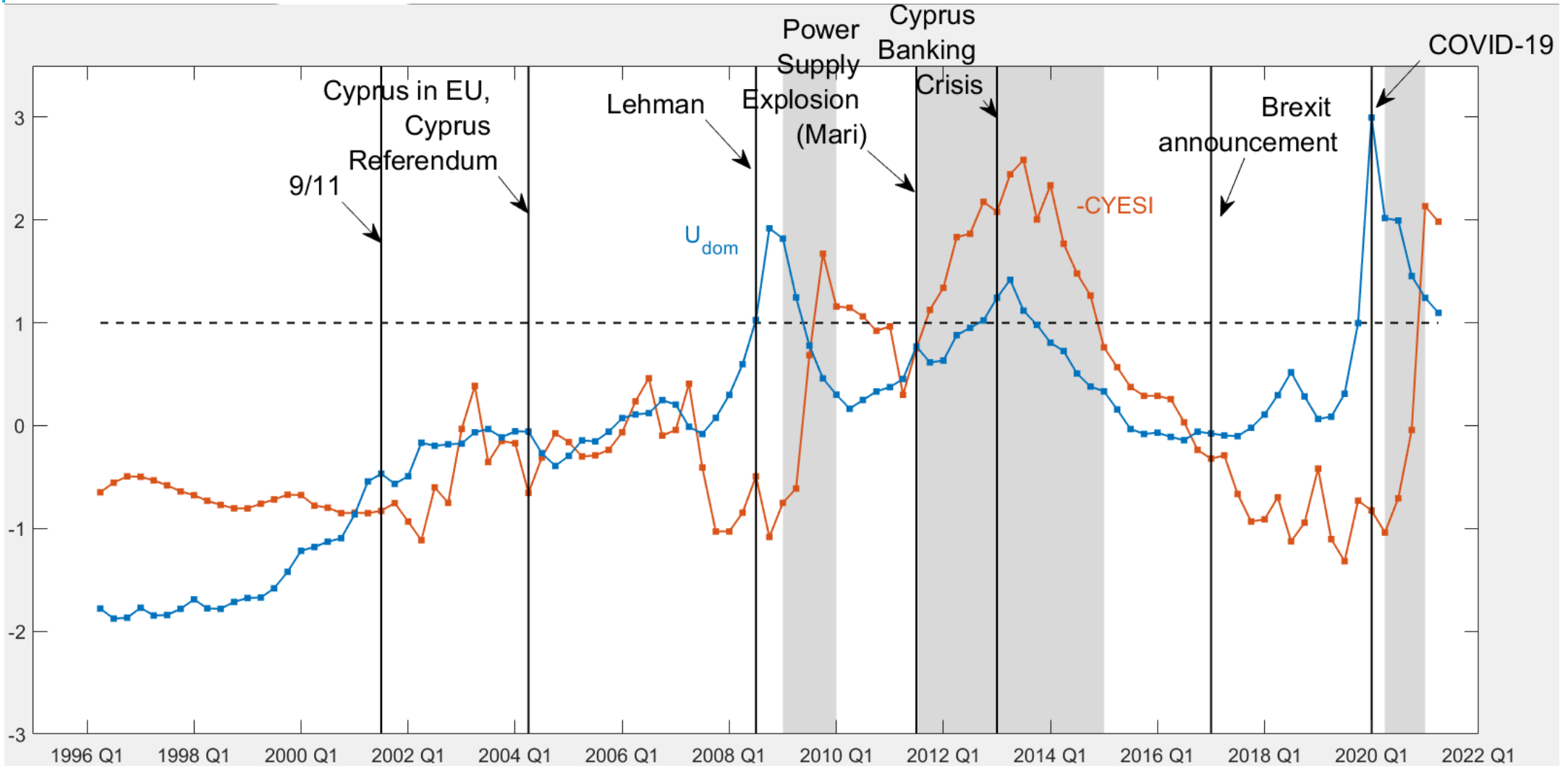
# DOMESTIC AND FOREIGN UNCERTAINTY MEASURES (JLN)



# JLN VS RS UNCERTAINTY MEASURES



# JLN UNCERTAINTY VS CYESI



# 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

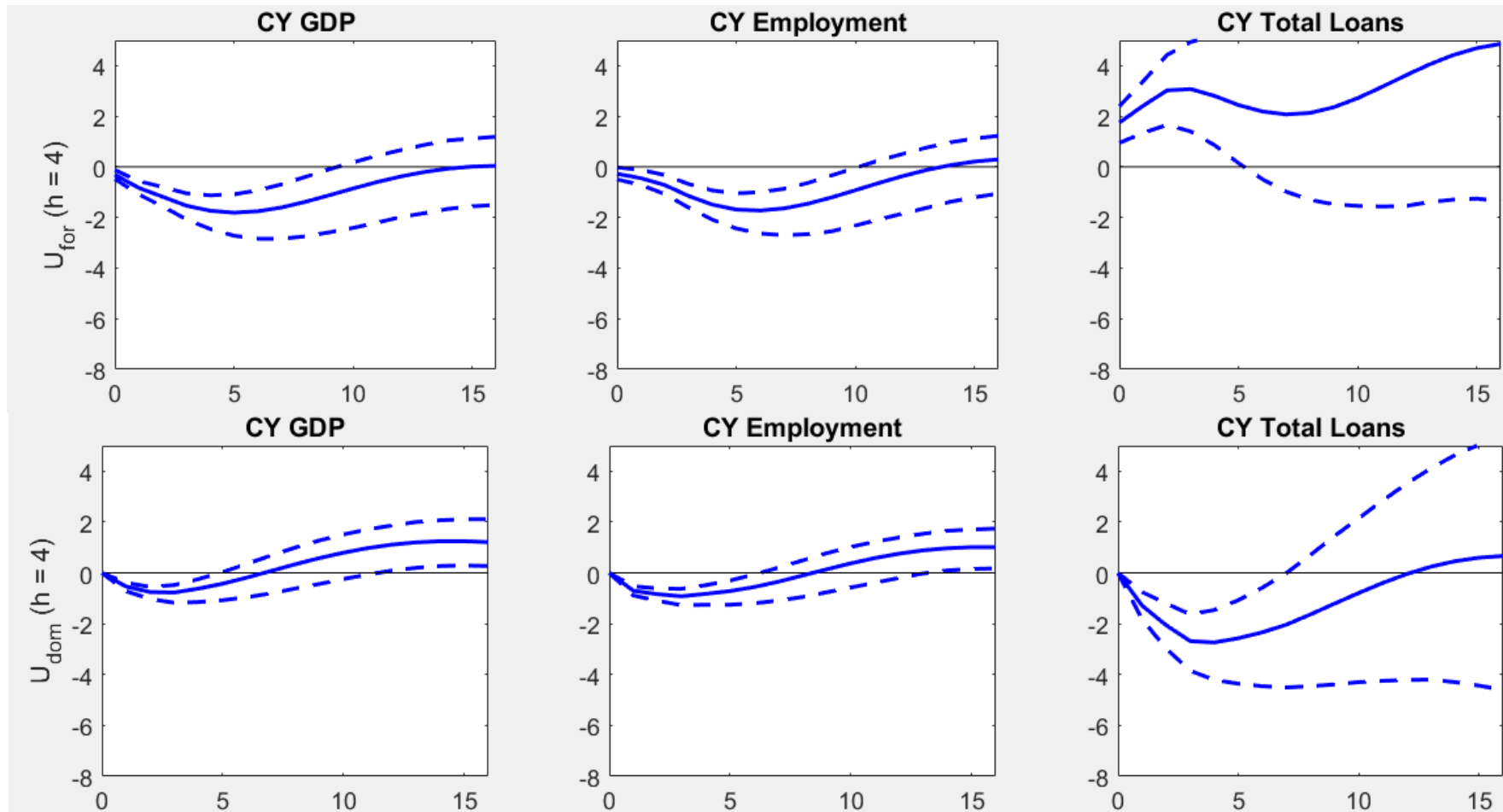
IR = interest rates on euro-denominated loans

Loans = Loans to non-MFIs

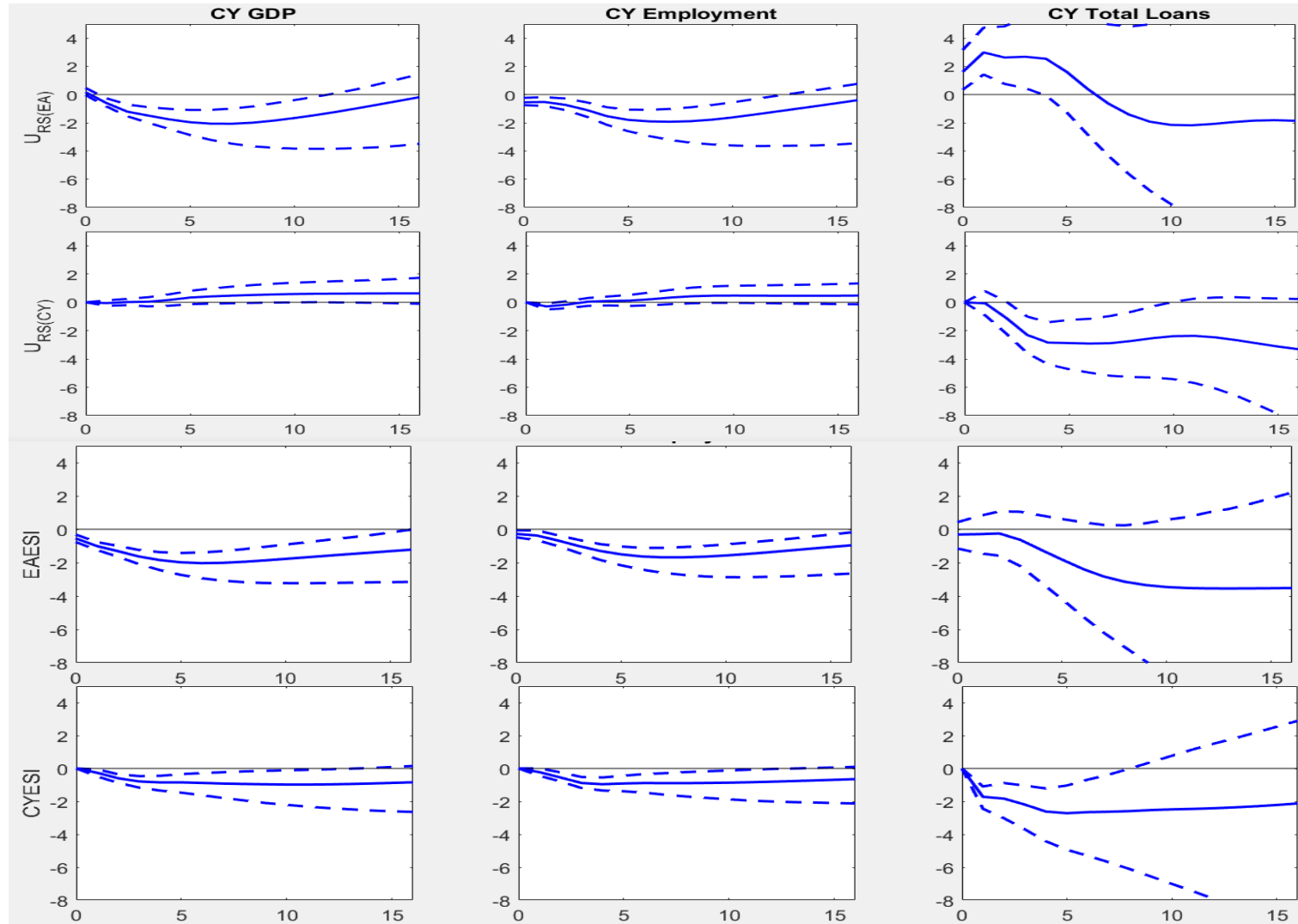
$$Y_t^{JLN} = \begin{pmatrix} U_{for} \\ \log(\text{GDP}) \\ \log(\text{EMP}) \\ \log(\text{CONS}) \\ \log(\text{CPI}) \\ \log(W) \\ \text{LMPI} \\ \text{IR} \\ \log(\text{Loans}) \\ U_{dom} \end{pmatrix}'$$



# 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**

