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Uncertainty and nonlinear macroeconomic effects of monetary policy in Tunisia: a SEIVAR-based analysis

The macroeconomic impact of a monetary policy shock in Tunisia during high and low uncertainty states

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1. MOTIVATION AND RESEARCH OBJECTIVES

Purpose: This paper investigates whether the macroeconomic effects of monetary policy shocks vary with the degree of macroeconomic uncertainty (domestic and foreign).

Design/methodology/approach: The authors use monthly Tunisian data from 2000 to 2023 and employ the Self-Exciting Interacted VAR (SEIVAR) to compute nonlinear generalized impulse response functions (GIRFs) to an orthogonalized monetary policy shock during tranquil and uncertain times. Here, we employ two measures of uncertainty. The first is Tunisia's world uncertainty index, regarded as “endogenous domestic uncertainty”. The second measure is the uncertainty of European economic policy, which is treated as “exogenous foreign uncertainty.”

2. EMPIRICAL METHODOLOGY

We use a fully nonlinear, or self-exciting, interacting VAR model to empirically examine whether the actual impacts of monetary policy shocks vary between periods of calm and periods of uncertainty. This model enhances a typical linear VAR model by incorporating an interaction term. In this study, the interaction term involves two endogenously modelled variables: the variable used to identify exogenous changes in monetary policy (i.e., the policy rate) and the variable assessed for its influence on the effects of monetary shocks (i.e., uncertainty). The SEIVAR model is calculated as follows:

$$Y_t = \alpha + \gamma \text{linear.trend} + \sum_{j=1}^L A_j Y_{t-j} + \left[\sum_{j=1}^L c_j R_{t-j} * \text{unc}_{t-j} \right] + u_t \quad (1)$$

$$\text{unc}_t = e'_{\text{unc}} Y_t \quad (2)$$

$$R_t = e'_R Y_t \quad (3)$$

$$E(u_t u'_t) = \Omega \quad (4)$$

2. EMPIRICAL METHODOLOGY

Theoretically, the GIRF at horizon h of the vector Y to a shock in date t , δ_t , calculated conditional on an initial history (or starting circumstances), $\overline{w}_{t-1} = \{Y_{t-1}, \dots, Y_{t-L}\}$, is provided by the following difference of conditional expectancies between the shocked and non shocked pathways of Y :

$$GIRF_{Y,t}(h, \delta_t, \overline{w}_{t-1}) = E\left[Y_{t+h} \mid \delta_t, \overline{w}_{t-1}\right] - E\left[Y_{t+h} \mid \overline{w}_{t-1}\right]$$

According to Cavigiano et al. (2015), conditioning reactions on severe occurrences instead of typical events may be crucial to avoid confusing comparable situations and missing empirical responses in favor of nonlinearity. Our state-dependent GIRFs may be characterized as follows in theory:

$$GIRF_{Y,t}(h, \delta_t, \Omega_{t-1}^{uncertain.times}) = E\left[GIRF_{Y,t}(h, \delta_t, \{\overline{w}_{t-1} \in \Omega_{t-1}^{uncertain.times}\})\right]$$

$$GIRF_{Y,t}(h, \delta_t, \Omega_{t-1}^{tranquil.times}) = E\left[GIRF_{Y,t}(h, \delta_t, \{\overline{w}_{t-1} \in \Omega_{t-1}^{tranquil.times}\})\right]$$

3.DATA

Variable	Treatment	Abbreviations	Units	Transformations	Source
Global uncertainty related to Tunisia	Endogenous	WHU	Number	Natural logarithm	<i>https://worlduncertaintyindex.com/data/</i>
European Economic policy uncertainty	Exogenous	EU EPU	Number	Natural logarithm	<i>https://www.policyuncertainty.com/europe_monthly.html</i>
Industrial production index	Endogenous	IPI	Index (2010=100)	Natural logarithm	<i>Tunisian national institute of statistic</i>
Consumer price index	Endogenous	CPI	Index (2010=100)	Natural logarithm	<i>Tunisian national institute of statistic</i>
Key Interest rate	Endogenous	INT	%	-	<i>Central bank of Tunisia</i>
Nominal effective exchange rate	Endogenous	NEER	Index (2010=100)	Natural logarithm	<i>International Financial Statistics - IMF Data</i>
Trade balance	Endogenous	TB	Ratio of exports to import of goods	Natural logarithm	<i>Central bank of Tunisia</i>

4. EMPIRICAL RESULT : EFFECT OF MONETARY POLICY UNDER BOTH REGIMES: (HIGH DOMESTIC UNCERTAINTY REGIME (RED) AND LOW DOMESTIC UNCERTAINTY REGIME (BLUE))

FIGURE 3.

EFFECT OF MONETARY POLICY ON IPI UNDER BOTH REGIMES: HIGH DOMESTIC UNCERTAINTY REGIME (RED) AND LOW DOMESTIC UNCERTAINTY REGIME (BLUE)

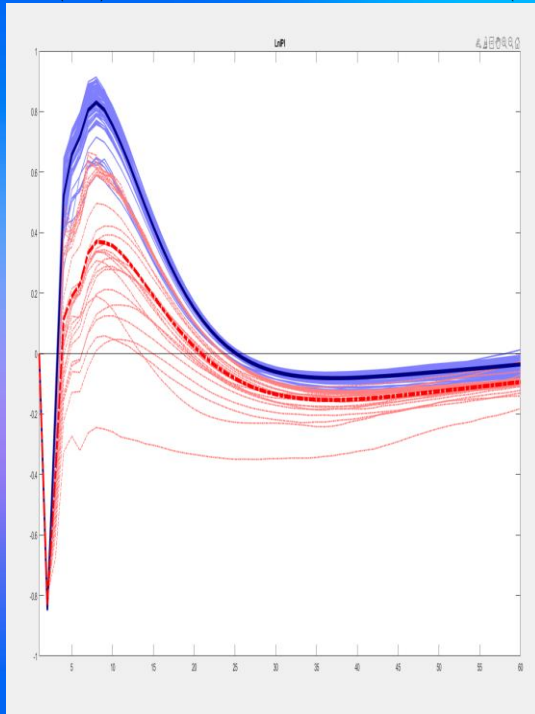
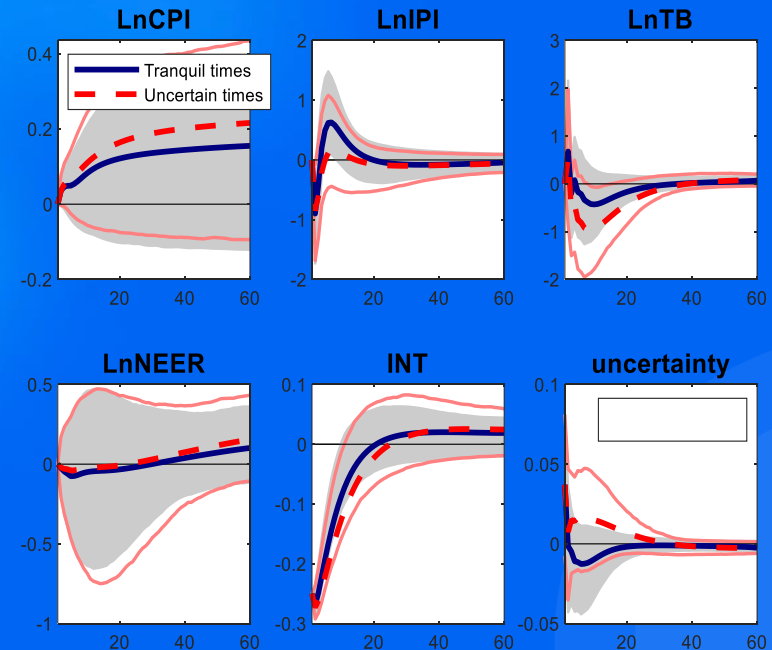


FIGURE 5.

EFFECT OF MONETARY POLICY ON ALL ENDOGENOUS VARIABLES UNDER BOTH REGIMES: HIGH DOMESTIC UNCERTAINTY REGIME (RED) AND LOW DOMESTIC UNCERTAINTY REGIME (BLUE)

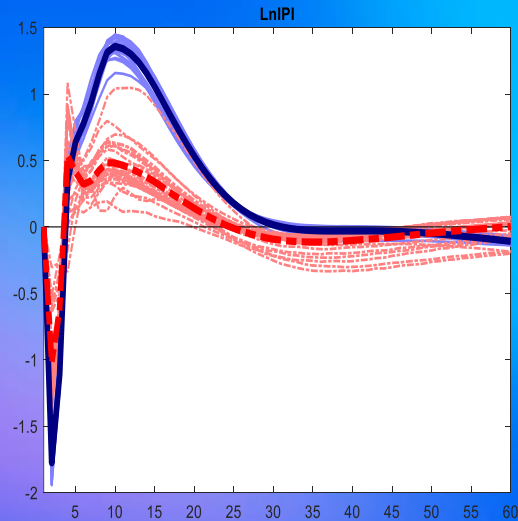


Note: Uncertain versus tranquil times state-conditional GIRFs (uncertainty proxy: Tunisian global world un). Blue solid lines, light blue bands and grey areas: Point estimates, 68% and 90% bootstrapped confidence bands for the GIRFs conditional to a tranquil times state, respectively. Red dashed lines, dark red dotted and light red solid bands: Point estimates, 68% and 90% bootstrapped confidence bands for the GIRFs conditional to an uncertain times state, respectively. x-axis in month.

4. EMPIRICAL RESULT : EFFECT OF MONETARY POLICY UNDER BOTH REGIMES (HIGH FOREIGN UNCERTAINTY REGIME (RED) AND LOW DOMESTIC UNCERTAINTY REGIME (BLUE))

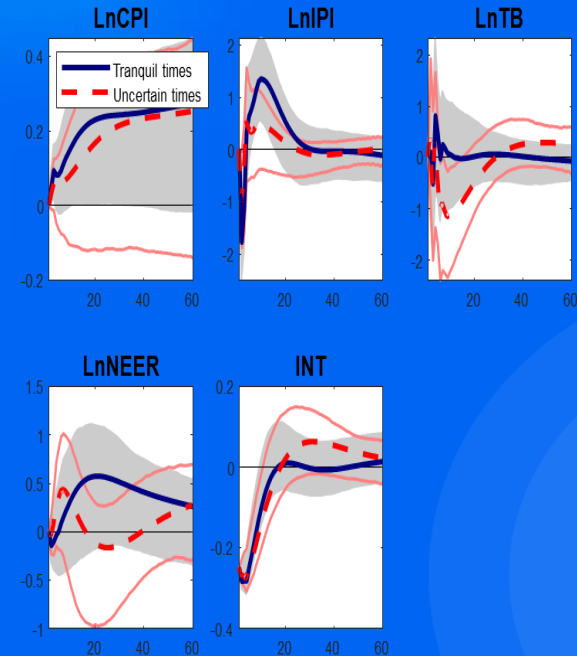
FIGURE 4.

EFFECT OF MONETARY POLICY ON IPI UNDER BOTH REGIMES: HIGH ECONOMIC EUROPEAN POLICY UNCERTAINTY REGIME (RED) AND LOW ECONOMIC EUROPEAN POLICY REGIME (BLUE)



Note: Uncertain versus tranquil times state -conditional responses for IPI (shock: 25 basis points unexpected decrease in the key interest rate). Left (right) column: Domestic uncertainty (foreign uncertainty) as uncertainty proxy. Solid blue (red dotted) line: State conditional GIRF for the tranquil times (uncertain times) state

Figure 6: Effect of monetary policy on all endogenous variable under both regimes: high European uncertainty regime (red) and low domestic uncertainty regime (blue).



5. ROBUSTNESS CHECK

Table : Tests for threshold VAR

Threshold variable	Estimated: Threshold Value	Wald Statistics					
		Sup-		Avg-		Exp-	
		Value	P-value	Value	P-value	Value	P-value
Domestic uncertainty WHU	0.16334	195.54459	0.000	166.17137	0.000	243.61444	0.0000
Foreign European uncertainty : EU-EPU	152	249.8448	0.0000	166.9683	0.028	165.8902	0.032

6.CONCLUSION

Results indicated that monetary policy is weaker in the high domestic and European uncertainty nations. Furthermore, heightened uncertainty also tends to diminish the influence of monetary policy in Tunisia. This suggests that when policy makers are confronted with significant uncertainty, they suffer a trade-off between responding decisively and acting accurately, and this result provides credence to theoretical studies that propose more active stimulus in uncertain times (see, e.g., Bloom, 2009; Bloom et al., 2018).

Thank you. Please feel free to ask any questions. 😊