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Holding the Economy by the Tail: Analysis of Short- and Long-run Macroeconomic Risks

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Aim:

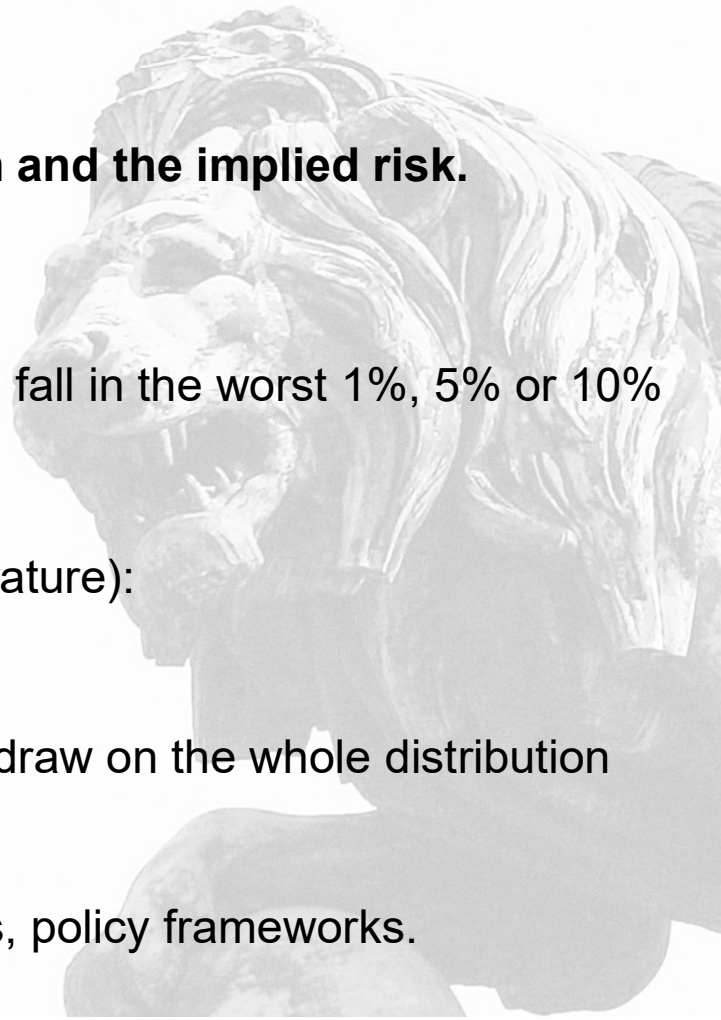
To examine distributions (especially tails) of US output growth and the implied risk.

Contribution:

Growth-at-Risk literature: “How low could a country’s output growth fall in the worst 1%, 5% or 10% of adverse economic scenarios four quarters ahead?”

We extend the scope of this question by (and in contrast to the literature):

1) Looking at distribution moments:
   - because policy response dealing with risk management can draw on the whole distribution
2) Looking at the long run:
   - how tail risk relates to the structure of the economy, trends, policy frameworks.



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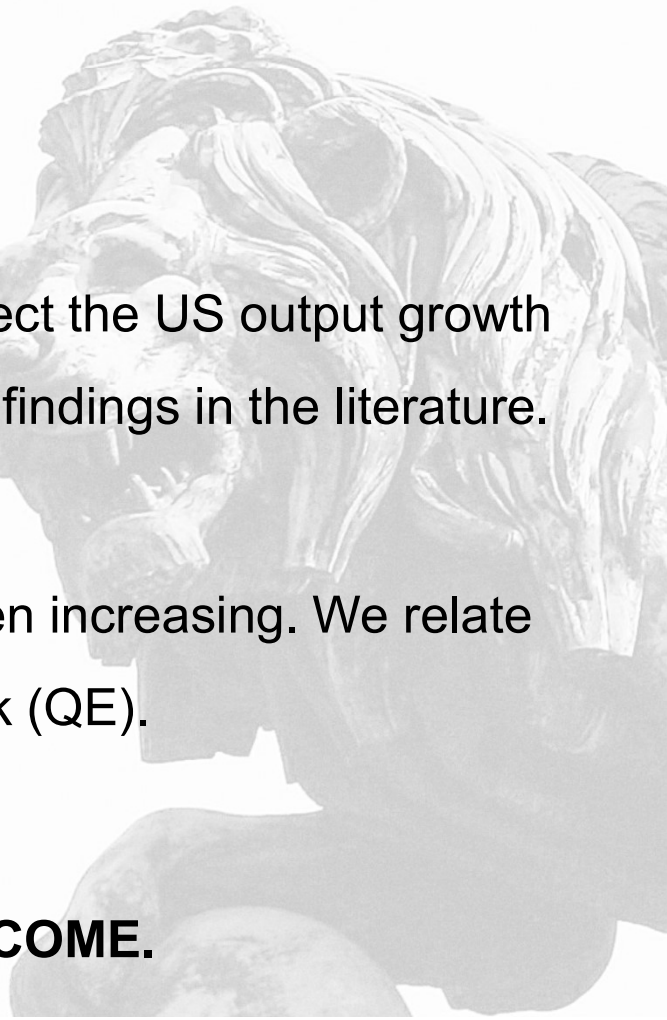
Findings:

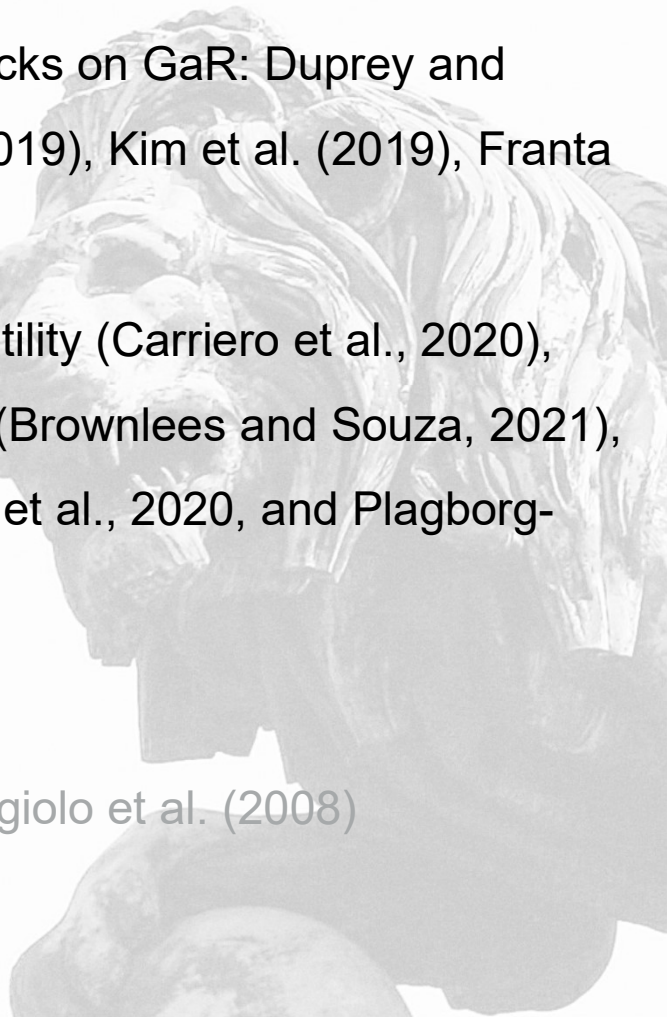
- (short-term) Monetary policy and financial shocks strongly affect the US output growth tail risk (and differently from the conditional mean) – confirms findings in the literature. We add: it is mainly through changes in skewness.
- (long-term) After the GFC, the long-run downside risk has been increasing. We relate the increase to the unconventional monetary policy framework (QE).



WORK IN PROGRESS, COMMENTS WELCOME.

Related Literature:

- GaR literature and linking GaR to financial variables: Cecchetti (2008), Adrian et al. (2019),…
- The effect of monetary policy, macroprudential policy and financial shocks on GaR: Duprey and Ueberfeldt (2020), Loria, Matthes, and Zhang (2019), Jung and Lee (2019), Kim et al. (2019), Franta and Gambacorta (2020) , Aikman et al. (2019)
- GaR based on parametric models: Bayesian VARs with stochastic volatility (Carriero et al., 2020), Markov-switching models (Caldara et al., 2020), GARCH-type models (Brownlees and Souza, 2021), and Skew t-distributions with time-varying parameters (Delle Monache et al., 2020, and Plagborg-Møller et al., 2020).
- The regimes of US monetary policy: Bianchi (2013), Liu et al. (2019)
- Moments of the US output growth distribution: Jensen et al. (2020), Fagiolo et al. (2008)



Model for Simulation of Predictive Distributions (Moments, Risks)

- An empirical non-linear macro-financial model - parametric approach (no quantile regressions, non-normal distributions), the model allows for an economic interpretation of change in moments/risks.

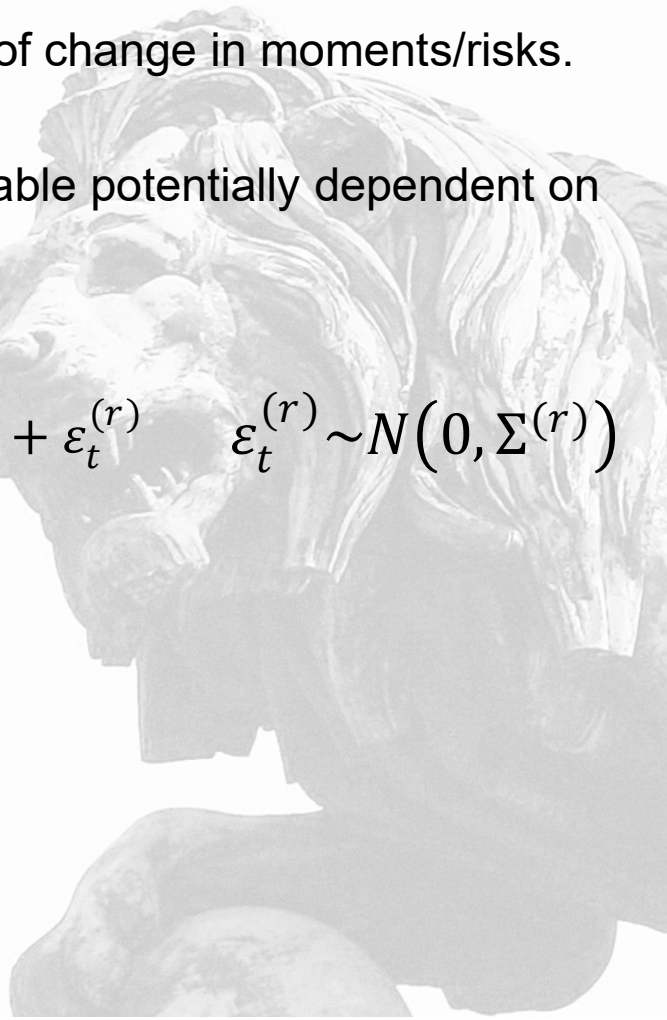
- Mean-adjusted threshold vector autoregression with the threshold variable potentially dependent on (the lags of) all endogenous variables (close to Balke, 2000):

$$y_t = A_1^{(r)} y_{t-1} + \cdots + A_p^{(r)} y_{t-p} + F^{(r)} - A_1^{(r)} F^{(r)} \cdots - A_p^{(r)} F^{(r)} + \varepsilon_t^{(r)} \qquad \varepsilon_t^{(r)} \sim N\left(0, \Sigma^{(r)}\right)$$

Two regimes: $y_t^{TR} < R$ $\qquad$ $y_t^{TR} \geq R$

Threshold variable: $y_t^{TR} \equiv \sum_{i=1}^{n} w_i MA^q(y_{it})$

Mean adjustment: $E(y_t) = F^{(r)}$



Data and Estimation:

Data: vector of endogenous variables: real GDP growth, CPI inflation, short-term interest rate, credit conditions variable (spread between 10-year bond yield and the FF rate).

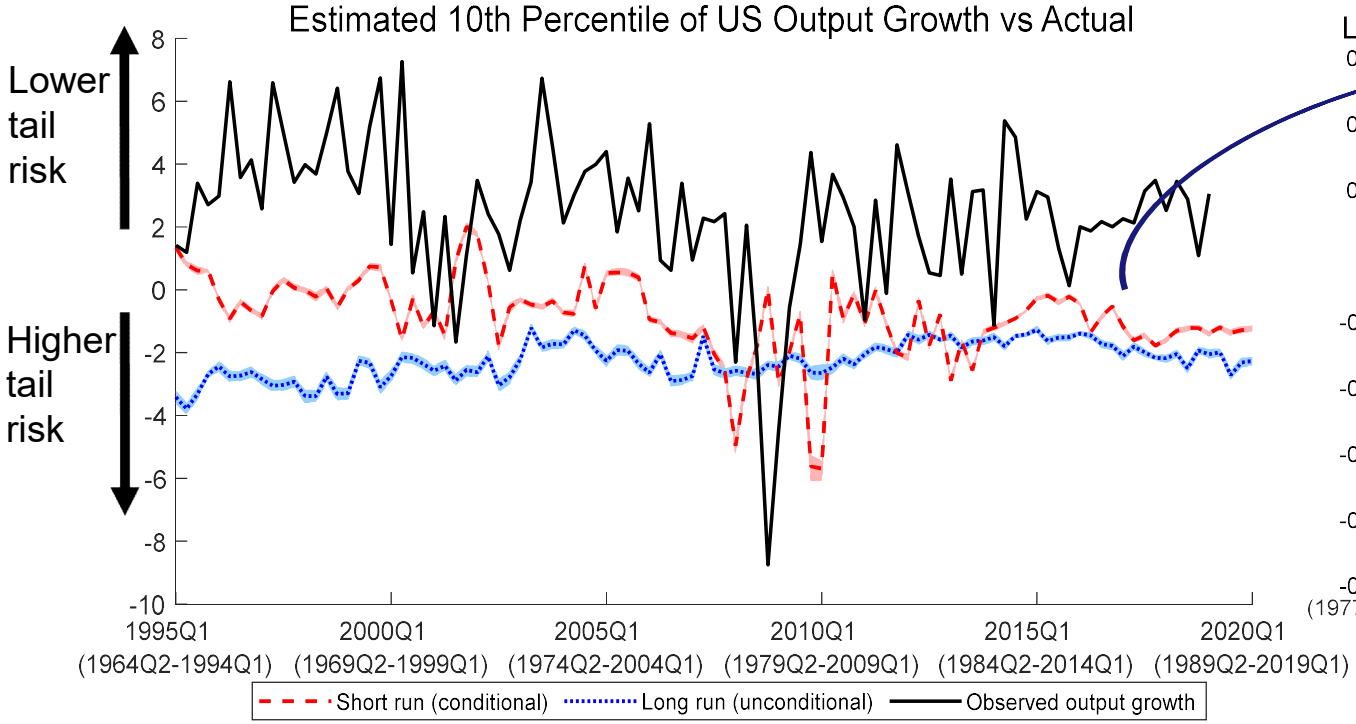
Estimation of the model: Bayesian approach – Gibbs sampler, estimated on windows of 30 years' length (first: 1964Q2-1994Q1, last 1989Q2-2019Q1):

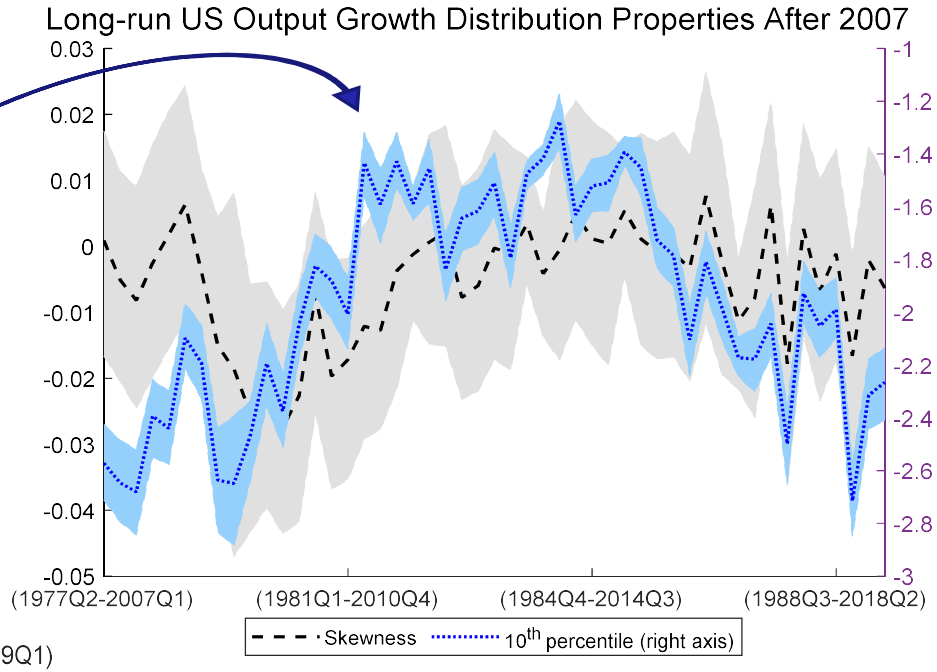
- constant window size important – parameters' uncertainty

Then: for each estimation window predictive distributions are simulated and:

1) For a fixed distance (4 quarters ahead) we obtain the conditional output growth distribution.
2) From the model simulation 1,048 periods ahead (discarding the first 48 to get rid of initial conditions) we obtain the long-run output growth distribution.

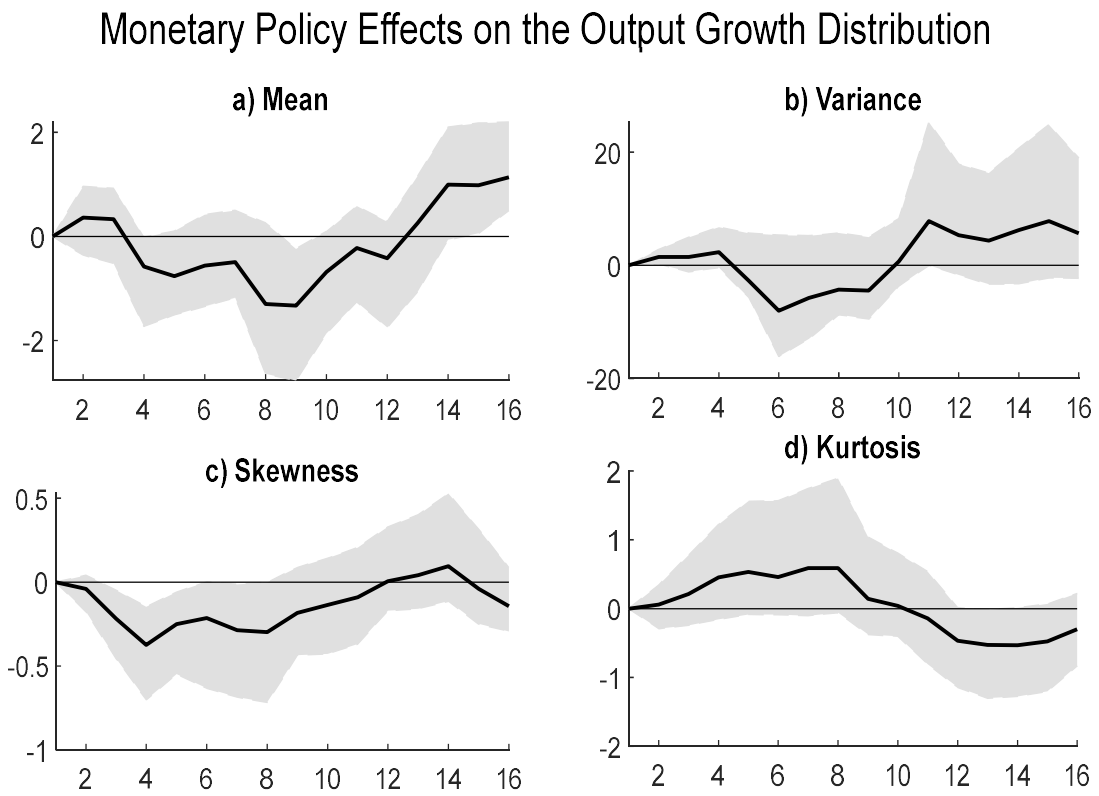
=> compute moments, GaR as a tail-risk measure (10^{th} percentile),…





- Short-run risk follows the business cycle, long-run risk exhibits trends, ex-post observed output growth serves as a rough check of the estimated percentiles.
- Our interest is in the recent increase in the long-run downside tail risk (GaR falls from -1.3% to -2.7%).
- To understand the long-run risk reversal, we start with effects of shocks on moments of conditional distribution.

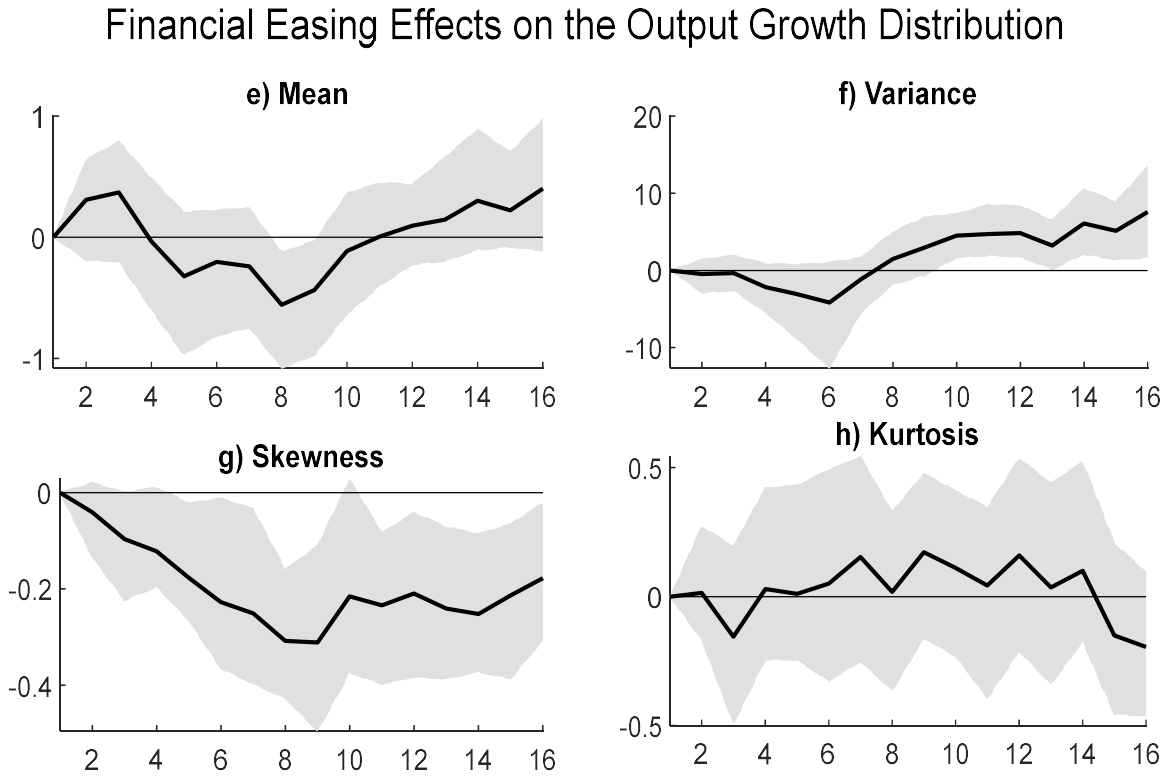
Short-run Analysis I:



Shock: unexpected 100-basis-points monetary policy tightening.

- Effects on moments estimated by local projections, shocks narratively identified - Wieland and Yang's (2020) extension of Romer and Romer (2004) until 2007Q4.
- The effect on the conditional mean as conventional, but the asymmetry of the distribution increases (towards low realizations of growth => the short-run tail risk temporarily increases).

Short-run Analysis II:



Shock: an unexpected 100-basis-points fall in the excess bond premium.

- Financial shocks are proxied by the exogenous part of the excess bond premium change from Gilchrist and Zakrajšek (2012), regularly updated to cover the period 1973Q1-2019Q.
- Credit spread easing shocks affect skewness negatively and increase the variance.

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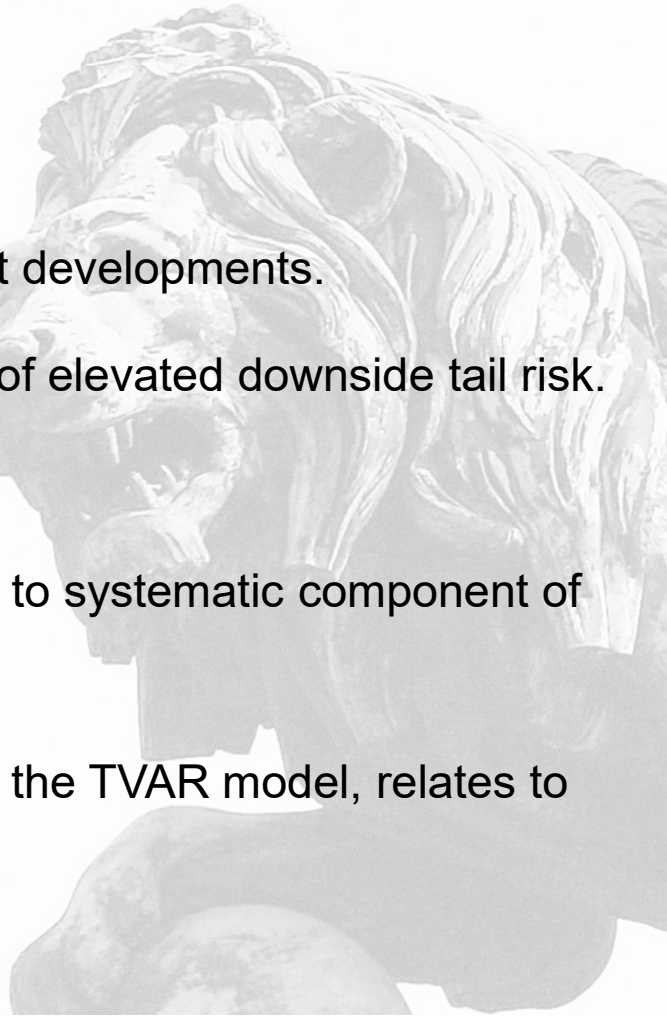
Long-run Analysis:



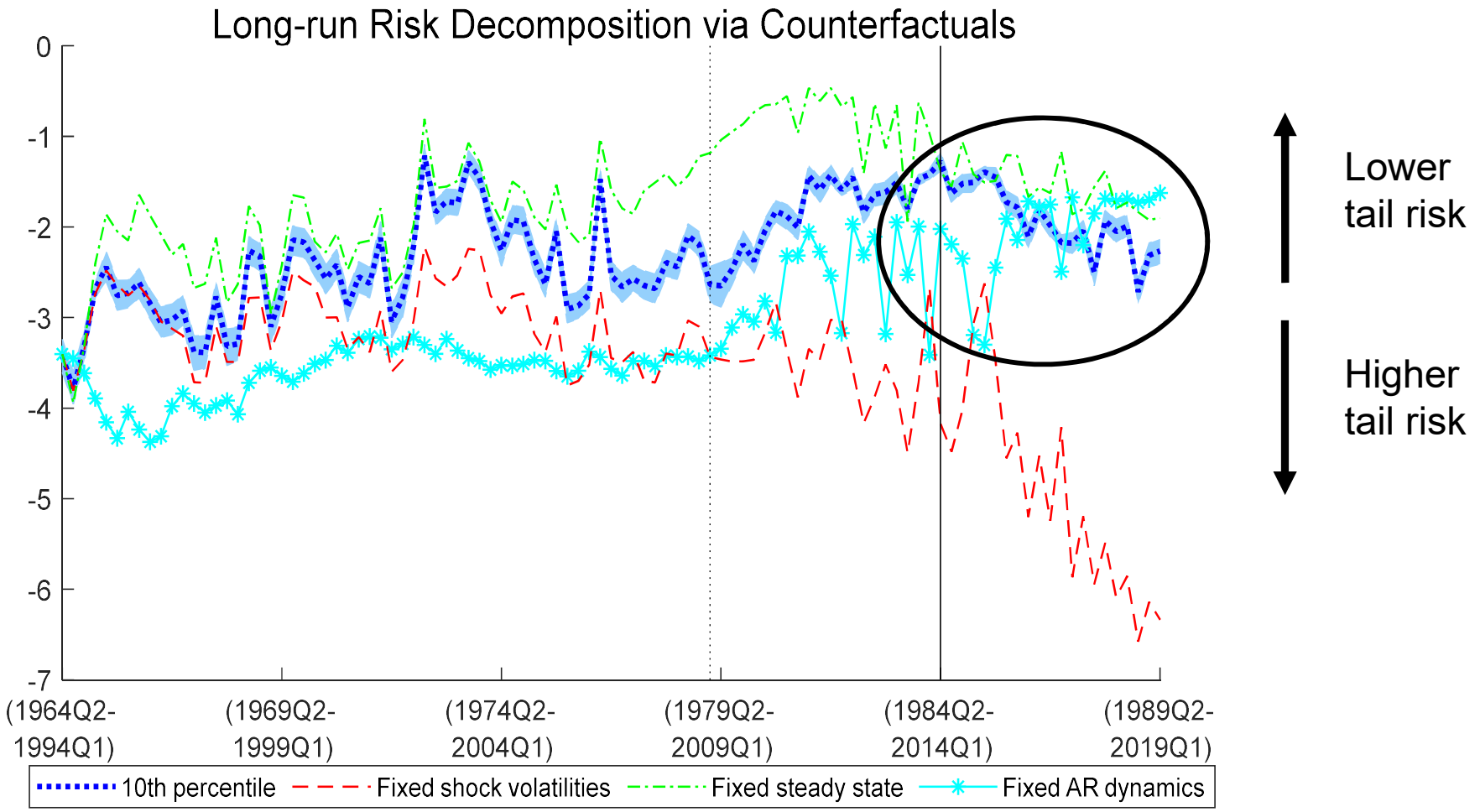
Aim: To understand the evolution of long-run risk and especially its recent developments.

Finding: The post-2008 monetary policy framework is a potential source of elevated downside tail risk.

Two types of argument:

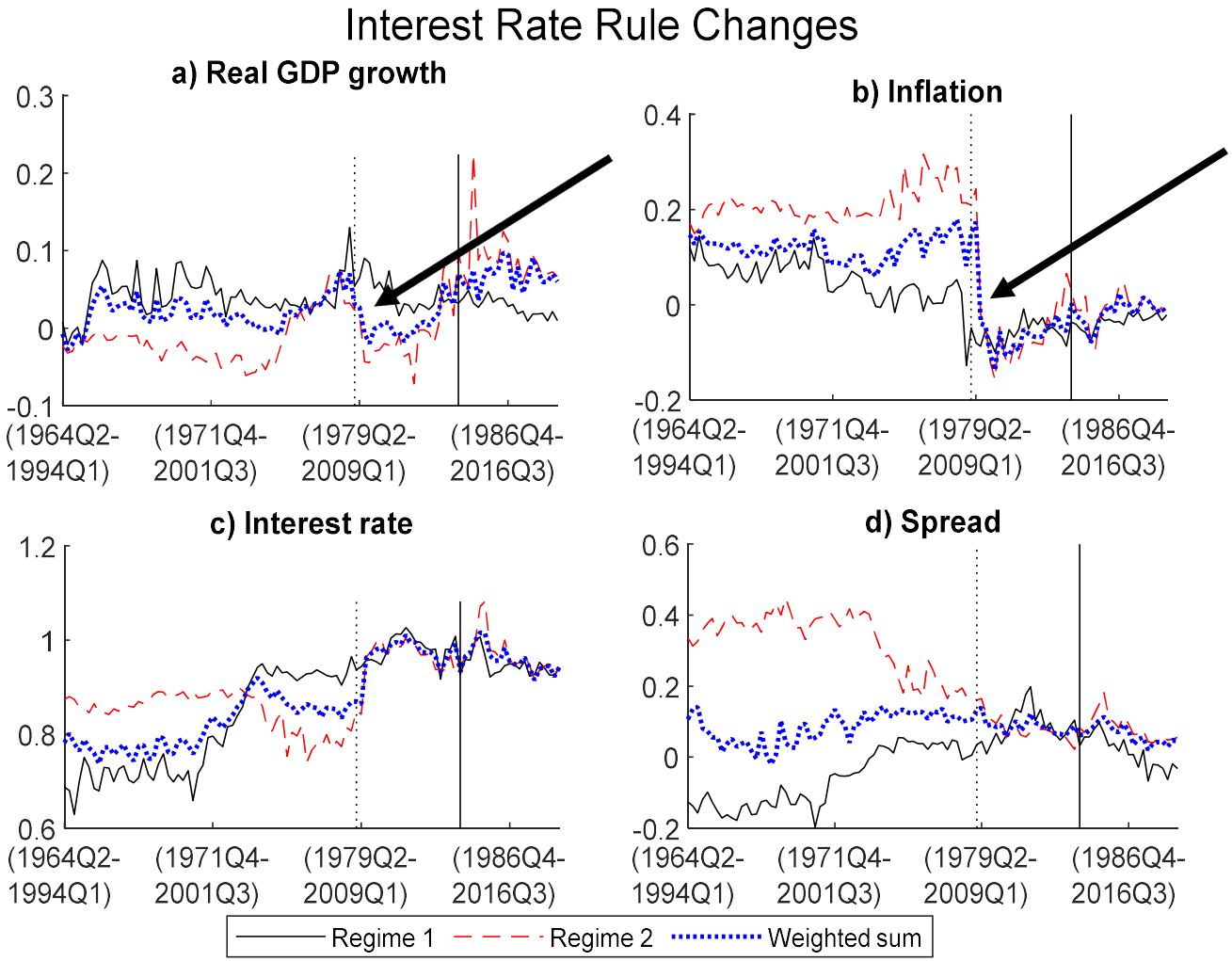
1. Based strictly on the TVAR model, the reduced-form evidence, relates to systematic component of policies.
2. Based on results from the short-run analysis, information from outside the TVAR model, relates to the nonsystematic component of the policies (structural shocks).

Argument 1:



- Counterfactuals show the role of various parameters' subsets in TVAR.
- An increasing role of (falling) shock volatilities.
- The post-2014 rise in long-run tail risk due to the short-run macroeconomic dynamics.

Argument 1:



MP regime change

Change in AR parameters explains elevated risk & the change describes regime change of monetary policy (in line with the literature – Bianchi, 2013) => MP regime change behind elevated risk

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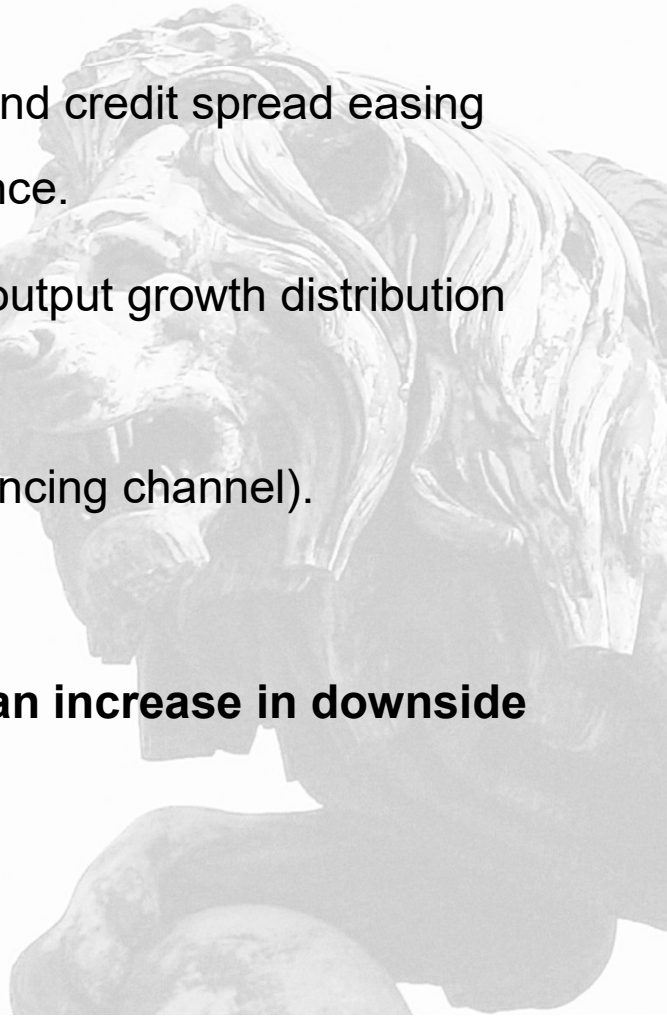
Argument 2:

- In the short run, interest rate shocks affect distribution symmetrically and credit spread easing shocks makes the distribution more asymmetric and with higher variance.
- MP regime based on interest rate implies a more symmetric long-run output growth distribution than the regime based on credit spread shocks.
- QE can be seen as realized through the credit spread (portfolio rebalancing channel).



=> QE is associated with an asymmetric distribution and thus with an increase in downside macroeconomic risk.

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Policy Implications and Conclusion:

- Two-stage procedure to examine macroeconomic tail risks:
    1. Estimation of predictive distributions (=>moments, => quantiles (tail risks))
    2. Analyses of short-run and long-run tail risks
- Example of policy implications:
    1. (short run) If the increasing asymmetry of the output growth distribution towards extremely low realizations after MP tightening is taken into account, policy tightening should be less aggressive than if it is based on the conditional mean forecast only.
    2. (long run) QE implies elevated downside risk (beyond and above the short-term fluctuations). So, such a MP framework should be accompanied by macroprudential regulation dealing with the increased risk.