Macroeconomic implications of oil price fluctuations: a regime-switching framework for the euro area

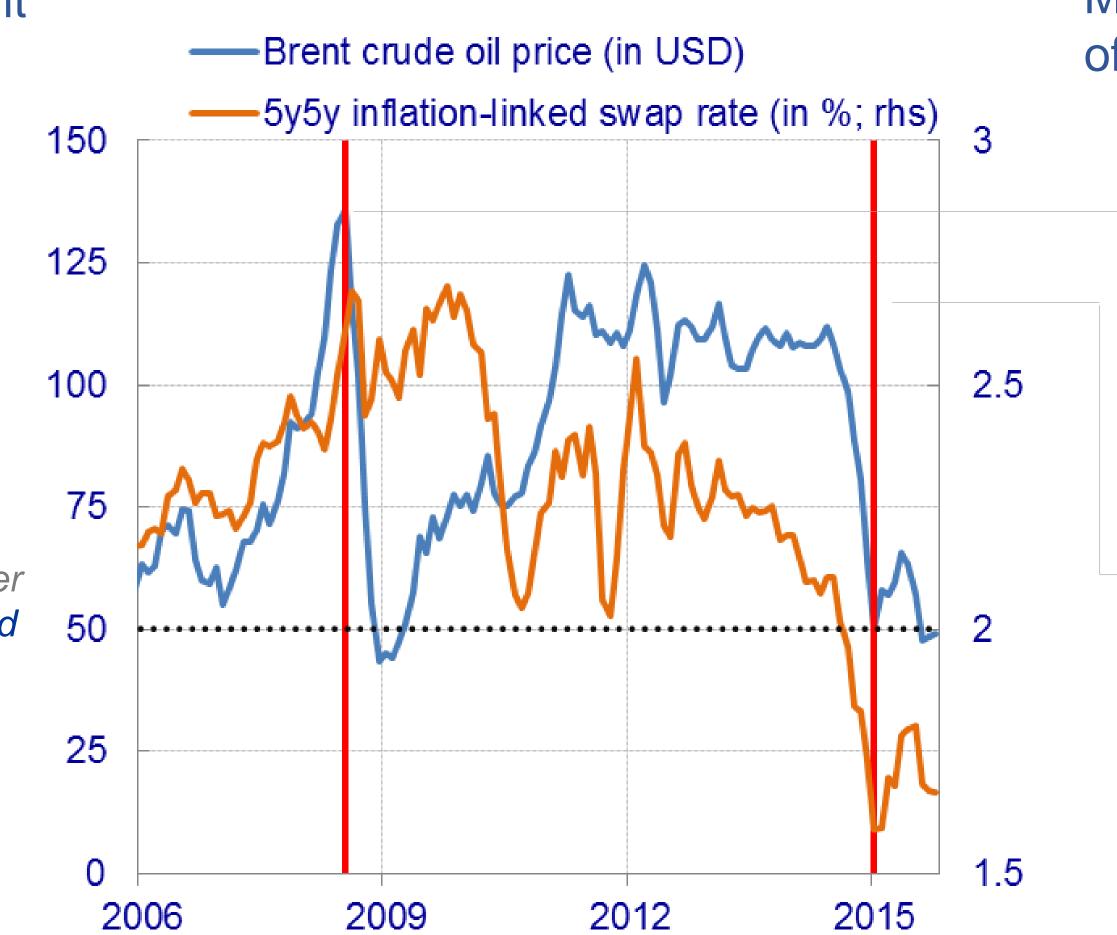## Fédéric Holm-Hadulla (European Central Bank) and Kirstin Hubrich (Federal Reserve Board)

Oil price fluctuations typically trigger divergent assessments

*Cheaper oil is a **rare piece of good news** for (…) the euro currency area, since [it] should boost the spending power of Europe's consumers (…) amid the eurozone's long slump.*

Wall Street Journal, 14 November 2014

*(...) a danger [of the oil-price slump] is that an even deeper dip in inflation (…) **may have an unwelcome second-round effect** by dragging down inflation expectations.*

The Economist, 4 December 2014

- Brent crude oil price (in USD)
- 5y5y inflation-linked swap rate (in %; rhs)

Monetary policy action often motivated by risk of oil-price induced second-round effects

*"(…) we decided at today's meeting to increase the key ECB interest rates by 25 basis points. **This decision was taken to prevent broadly based second-round effects**."*

Introductory Statement, 3 July 2008

*"While the sharp fall in oil prices over recent months remains the dominant factor driving current headline inflation, the **potential for second-round effects (…) has increased. This assessment is underpinned by a further fall in market-based measures of inflation expectations**."*

Introductory Statement, 22 January 2015

Paper uses regime-switching model with time-varying transition probabilities to investigate whether response of euro area macro-economy to oil price shocks undergoes episodic changes

VAR model: $y_t = [\Delta ip, \pi, \Delta poil, FX, \pi^e, R]$, where:
- ip: industrial production;
- π: HICP inflation;
- $poil$: Brent crude oil price (in USD);
- EXR: USD/EUR exchange rate;
- π^e: 5Y5Y BEIR;
- R: 3-month EURIBOR.

Data: euro area aggregates, monthly frequency, y-o-y changes in % for Δip, π and $\Delta poil$; remaining variables in % per annum; Feb 2004 to Jan 2015 (availability of 5Y5Y BEIR is restraining factor for start of sample period); sample extension to Dec 2015

Identification: Cholesky decomposition, variables ordered as shown above

Regime-switching set-up: $A_0(s_t^c)y_t = A_+(s_t^c)x_t + \Xi^{-1}(s_t^v)\varepsilon_t$, where:
- y_t: endogenous variables; $x_t' = [y_{t-1}', \dots, y_{t-p}', 1]$
- ε_t: vector of standard normal shocks
- $A_0(s_t^c)$, $A_+(s_t^c)$: coefficient matrices
- $\Xi^{-1}(s_t^v)$: diagonal matrix with standard deviations of shocks
- $s_t = (s_t^c, s_t^v)$: unobserved state variables evolve according to two independent first-order Markov processes (in constant transition matrix MS-SVAR model)
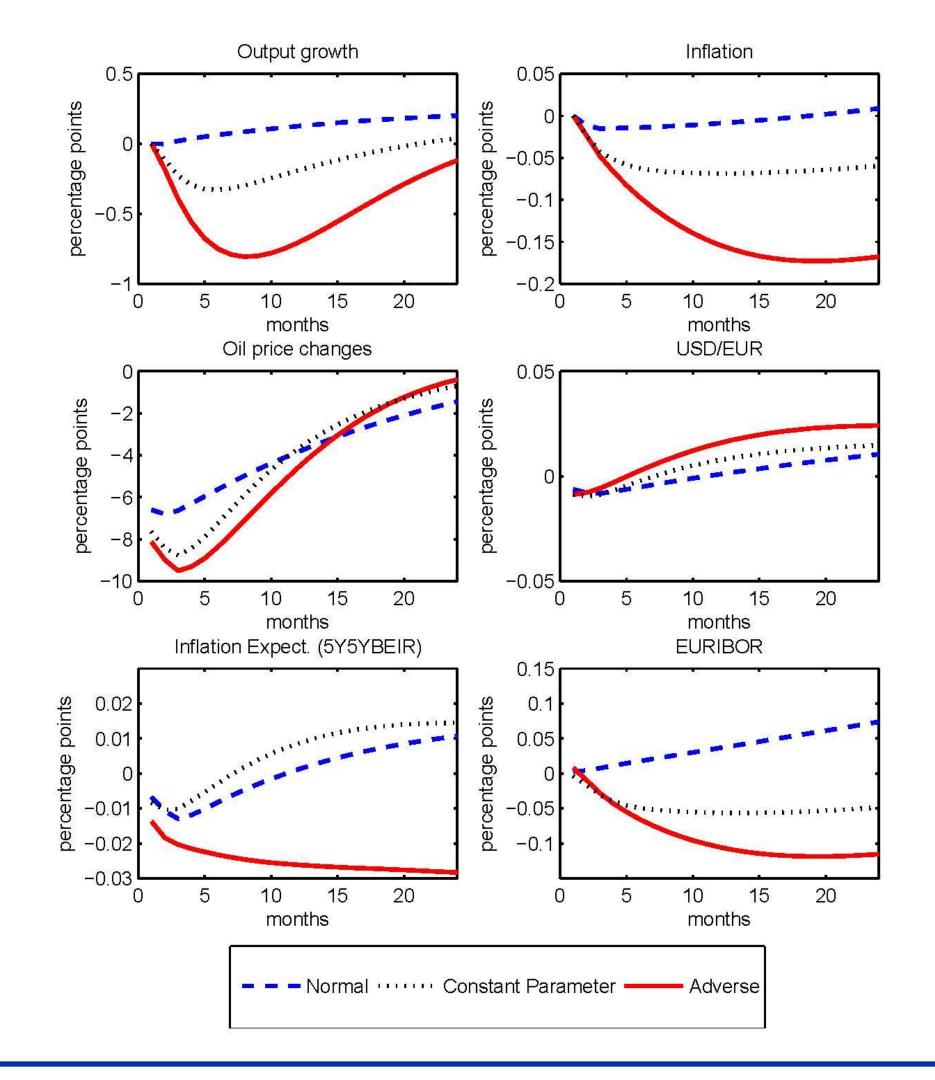- Persistence of regime depends on oil price inflation

Previous MS-VAR literature: constant transition matrix (Sims, Waggoner Zha, 2008)*

Model used in this paper: time-varying transition matrix (Hubrich, Waggoner and Zha, 2015)**

*   See Sims, C. A., Waggoner, D. F. and Zha, T. (2008). Methods for inference in large multiple-equation Markov-switching models, Journal of Econometrics 146(2): 255–274.
** See Hubrich, K., Waggoner, D. and Zha, T. (2016). Monetary policy and financial stability: Unconventional monetary policy, leverage and financial stress. Manuscript, Federal Reserve Board.

Impulse response functions reveal relevant differences in economic dynamics across 'normal' and 'adverse' regimes; responses of inflation expectations (and wage growth) point to second-round effects as a potential driver of the dynamics characterising the adverse regime
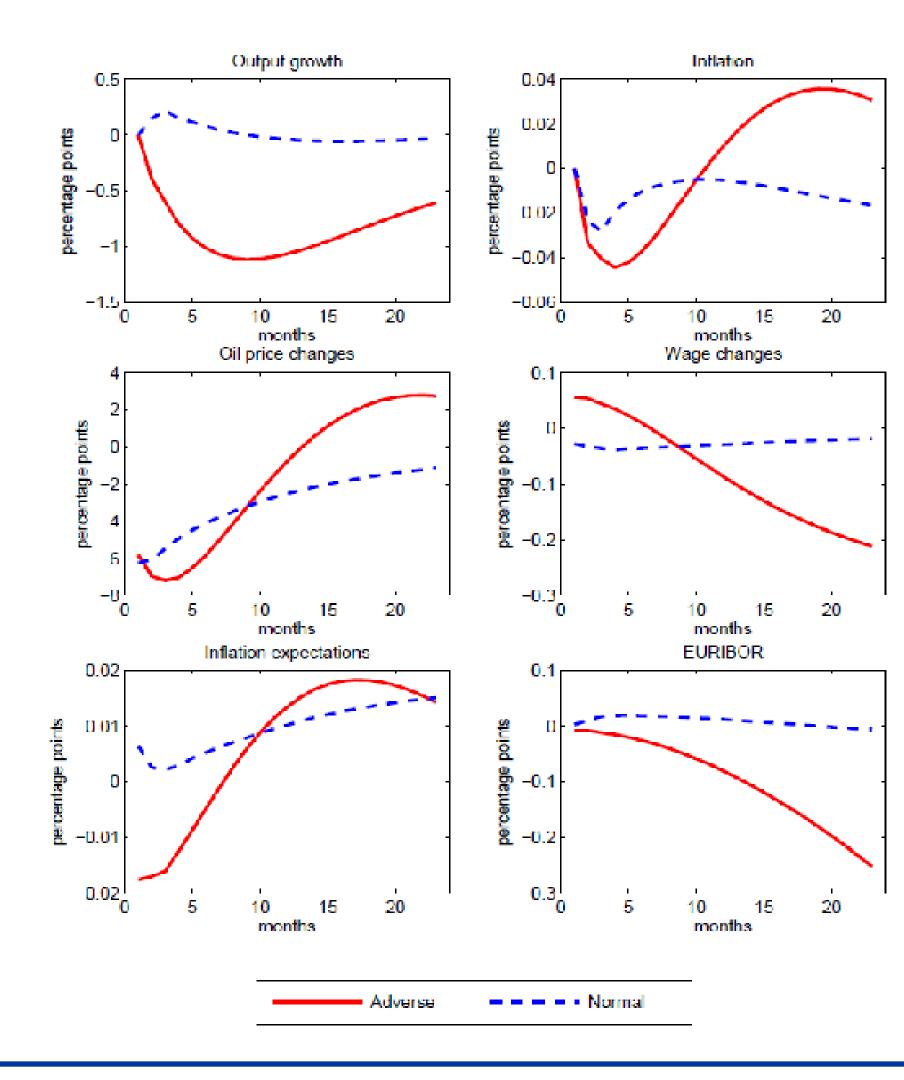

- Normal regime:
  - oil price shocks only trigger small macroeconomic effects
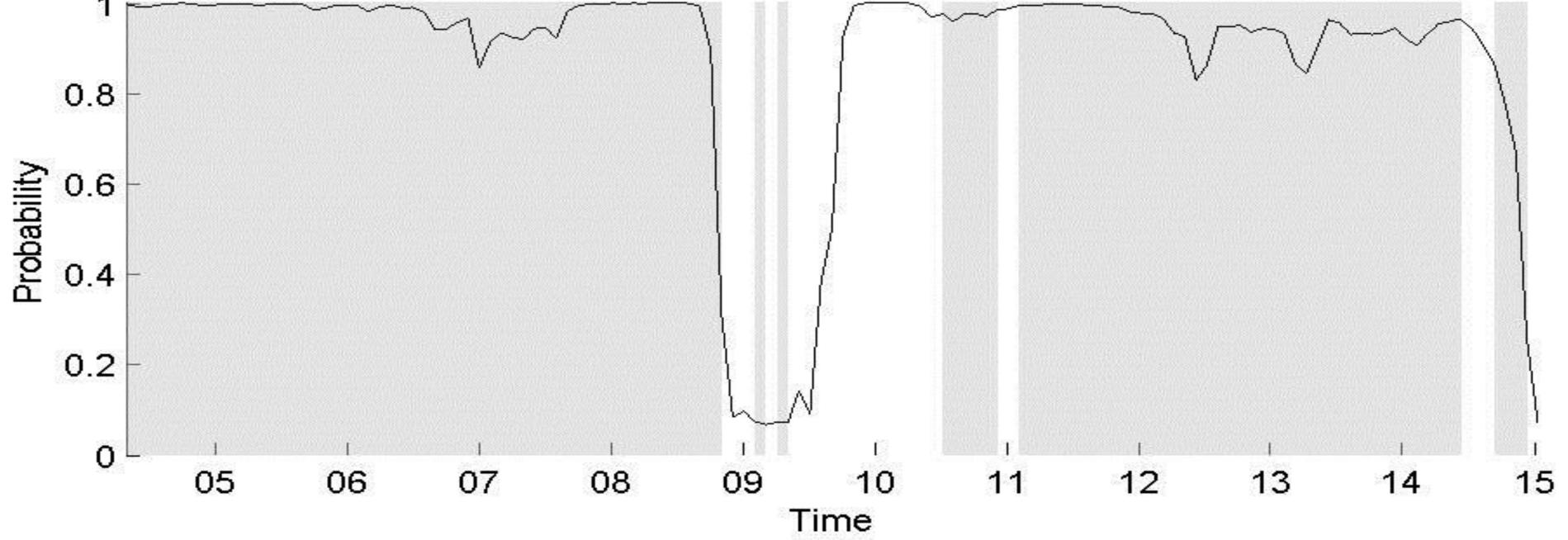- Adverse regime:
  - growth, inflation and inflation expectations all decline
  - effects are long-lasting
  - MP loosens but not sufficiently to pre-empt second-round effects
- Constant parameter VAR:
  - may underestimate effect of oil price shock in adverse regime
  - may give wrong sign for output and inflation in normal regime
- Wage-price spirals as channel for 2nd-round efx (Hoffmann et al. 2012); see IRFs in RHS chart
- Long-term real interest rate as channel (Obstfeld et al. 2016) not a likely driver of 2nd-round efx (not reported)

Economy entered adverse regime at various occasions, with switches typically arising after sequence of pronounced, unidirectional oil price changes; conditional probability of staying in normal regime declined steeply in 2014H2 → supports unfavourable interpretation of that episode

Probability of being in a normal regime (grey-shaded area) and conditional probability of staying in that regime (black line)