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)

(The views expressed here are those of the authors and do not necessarily reflect those of the European Central Bank or the Federal Reserve System or its staff.)

Oil price fluctuations typically trigger divergent assessments

Cheaper oil is a rare piece of good news for (...) the euro currency area, since (...) 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

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: \( y_t = [\Delta p_t, \pi, \Delta \text{oil}, FX, \pi', R] \), where:
- \( \Delta p_t \): industrial production;
- \( \pi_t \): HICP inflation;
- \( \Delta \text{oil} \): Brent crude oil price (in USD);
- \( FX \): USD/EUR exchange rate;
- \( \pi' \): SPSY BEIR;
- \( R \): 3-month EURIBOR.

Data: euro area aggregates, monthly frequency, y-o-y changes in % for \( \Delta p_t, \pi_t \) and \( \Delta \text{oil} \); remaining variables in % per annum; Feb 2004 to Jan 2015 (availability of SPSY 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: \( A_t(y_t | y_{t-1}) = A_1(y_t | y_{t-1}) + \mathbf{Z}^{-1}(y_t | y_{t-1}) \), where:
- \( y_t \): endogenous variables; \( \pi_t = [\pi_{t-1}, ..., \pi_{t-p}, 1] \)
- \( r_t \): vector of standard normal shocks
- \( A_t(\pi_t) \): coefficient matrices
- \( \mathbf{Z}^{-1}(y_t | y_{t-1}) \): diagonal matrix with standard deviations of shocks
- \( x_t = (x_t'; z_t); \): 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)**

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 \( \rightarrow \) 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)