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Documentation Note

Documentation note for box: “To what extent do international impulses affect the Norwegian Economy?” Monetary Policy Report 3/25

About the publication

Documentation Notes provide concise documentation of analyses or calculations featured in the Monetary Policy Report, speeches, and other publications where opportunities for further elaboration are constrained. An important goal of the Documentation Notes is to make the analyses more accessible to a broader audience, thereby contributing to verifiability and transparency. In some cases, related code and datasets will also be included.

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Documentation note for box: "To what extent do international impulses affect the Norwegian Economy?"

The basis for this analysis is a Bayesian estimated reduced-form vector autoregression (VAR) model, expressed as:

$$y_t = c + \sum_{l=1}^{4} B_l y_{t-l} + u_t$$

Here, y_t is a vector that includes the following endogenous variables: overall GDP and core inflation for OECD countries, oil prices, Norwegian core inflation, Norwegian mainland GDP growth, the krone exchange rate (I-44) and Norwegian and international money market rates.[1] For the money market rate, we use deviations from trend, while for the other variables, we use four-quarter growth rates. Furthermore, c is a vector of constants, while B_l, $(l = 1,2,3,4)$ is an 8×8 matrix of coefficients determining how the endogenous variables at time t, are influenced by lagged values of the same variables. u_t is a vector of residuals. The parameters c, B_l and the covariance matrix of u_t are first estimated from a Bayesian perspective.[2] The model is estimated on quarterly data for the period 1995 Q1 to 2024 Q4.

The residuals, u_t, are assumed to be combinations of underlying structural shocks. By using the covariance matrix of u_t, together with assumptions about how the shocks affect the observable variables y_t, we can identify the structural shocks and analyse how the endogenous variables in the model respond over time. This makes it possible to quantify how much each individual shock contributes to the variation in different variables.[3]

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[1] The international money market rate is a trade-weighted aggregate of the money market rates of Norway's main trading partners (Euro area, US, UK and Sweden). The remaining international data are obtained from LSEG Datastream.

[2] In the estimation, we apply so-called Minnesota priors.

[3] A more detailed description of the identification procedure is provided in Arias, J.E, J.F. Rubio-Ramírez and D.F. Waggoner (2018) "Inference Based on Structural Vector Autoregressions Identified With Sign and Zero Restrictions: Theory and Applications". *Econometrica*, 86 (2), pages 685-720.

To identify the structural shocks, we employ sign restrictions based on economic theory. The assumptions about how the structural shocks initially affect the variables in the model, y_t, are shown in Table A. The identification reflects the fact that Norway is a small open economy, where shocks specific to Norway do not affect international variables. For international shocks, we impose no restrictions on the Norwegian variables. The assumptions regarding the effects of domestic and international supply and demand shocks are consistent with standard economic theory. Monetary policy shocks are intended to capture unexpected changes in the level of interest rates abroad and in Norway. The oil price shock captures variation in oil prices beyond what can be explained by international business cycle conditions. The risk premium shock captures variation in the exchange rate beyond those explained by the other shocks in the model

Table A Identification using sign and zero restrictions

	Supply	Demand	Interest rate	Risk premium	International supply	International demand	Oil price	International interest rate
CPI-ATE	+	+	-	+				
Mainland GDP	-	+	-					
I44		-	-	+				
Interest rate		+	+	+				
Global inflation	0	0	0	0	+	+	+	-
Global GDP	0	0	0	0	-	+	-	-
Oil price	0	0	0	0	-	+	+	-
Global interest rate	0	0	0	0		+		+