SVAR-based supply and demand decomposition of inflation

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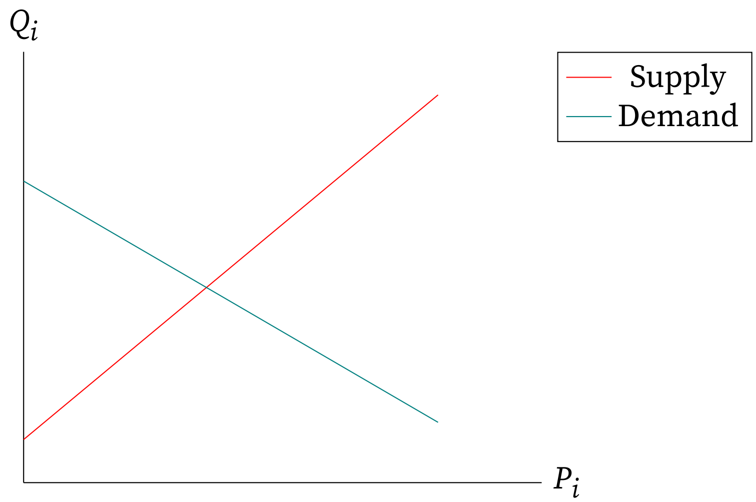
Available at https://github.com/PierreRlld/SVAR3A

1. Methodology

1.1. Method of *Shapiro (2022)*

The methodology proposed by Adam Hale Shapiro in his 2022 paper "Decomposing Supply and Demand Driven Inflation" takes its foundations in the work of Jump and Kohler (2022). The core assumption of the framework is that for each sector/section (i) of the inflation decomposition, an upward sloping in price supply curve and a downward demand curve can be assumed.



In theory, assuming $\sigma_i > 0$ and $\delta_i > 0$, we have:

$$\begin{aligned} \text{Supply}: \quad & Q_i = \sigma_i.P_i + \alpha_i \\ \text{Demand}: \quad & P_i = -\delta_i.Q_i + \beta_i \end{aligned}$$

Shocks are then defined as vertical movements of the curves :

$$\begin{aligned} \text{Supply shock}: \varepsilon_t^s = \Delta\alpha_i \ &= (Q_{i,t} - \sigma_i P_{i,t}) - (Q_{i,t-1} - \sigma_i P_{i,t-1}) \\ \rightarrow \varepsilon_t^s &= \Delta Q_{i,t} - \sigma_i \Delta P_{i,t} \\ \text{Demand shock}: \varepsilon_t^d = \Delta\beta_i \ &= (P_{i,t} + \delta_i Q_{i,t}) - (P_{i,t-1} + \delta_i Q_{i,t-1}) \\ \rightarrow \varepsilon_t^d &= \Delta P_{i,t} + \delta_i \Delta Q_{i,t} \end{aligned}$$

We can easily show that the two previous equations lead to :

$$\Delta Q_{i,t} = \frac{1}{1+\delta_i}(\varepsilon_t^s + \sigma_i.\varepsilon_t^d)$$
$$\Delta P_{i,t} = \frac{1}{\sigma_i(1+\delta_i)}(\sigma_i.\varepsilon_t^d - \delta_i.\varepsilon_t^s)$$

As we assume $\sigma_i > 0$ and $\delta_i > 0$, we can derive expected comovements between the two variables following supply and demand shocks.

$$\begin{array}{rlll} \text{Supply shock } \Delta^+\varepsilon^s : & \Delta^+ Q \quad \& \quad \Delta^- P & & \text{> Negative comovements} \\ \text{Demand shock } \Delta^+\varepsilon^d : & \Delta^+ Q \quad \& \quad \Delta^+ P & & \text{> Positive comovements} \end{array}$$

Consider the following structural VAR of (arbitrary) order p (dropping i indices) and let $z_t = \begin{bmatrix} \Delta Q_t \\ \Delta P_t \end{bmatrix}$ and $\varepsilon_t = \begin{bmatrix} \varepsilon_t^s \\ \varepsilon_t^d \end{bmatrix}$:

$$A. \begin{bmatrix} \Delta Q_t \\ \Delta P_t \end{bmatrix} = \mu + \sum_{i=1}^{p} A_i.z_t + \begin{bmatrix} \varepsilon_t^s \\ \varepsilon_t^d \end{bmatrix}$$

With ν_t the residuals of the estimated reduced-form VAR(p) we should have $\nu_t = A^{-1}.\varepsilon_t$
Let A satisfy $A \equiv \begin{pmatrix} 1 & -\alpha \\ \beta & 1 \end{pmatrix}$ with $\alpha, \beta > 0$, it follows that $A^{-1} = \frac{1}{1+\alpha\beta} \begin{pmatrix} 1 & \alpha \\ -\beta & 1 \end{pmatrix}$
Omitting the t indices we have :

$$\begin{bmatrix} \nu^s \\ \nu^d \end{bmatrix} = A^{-1}. \begin{bmatrix} \varepsilon^s \\ \varepsilon^d \end{bmatrix}$$
$$\begin{bmatrix} \nu^s \\ \nu^d \end{bmatrix} = \frac{1}{1+\alpha\beta} \begin{pmatrix} 1 & \alpha \\ -\beta & 1 \end{pmatrix} \begin{bmatrix} \varepsilon^s \\ \varepsilon^d \end{bmatrix}$$

As $\frac{1}{1+\alpha\beta} > 0$, we finally have:

$$\nu^s \propto \varepsilon^s + \alpha.\varepsilon^d$$
$$\nu^d \propto -\beta.\varepsilon^s + \varepsilon^d$$

1.2. Method of *Sheremirov (2022)*

2. Estimation

3. Results