Monetary Policy Transmission in the Euro Area: Is this Time Different? Chapter II: A Tale of Inflation, Expectations and Shocks

Andrejs Zlobins

Bank of Latvia, Tallinn University of Technology

December 1, 2025

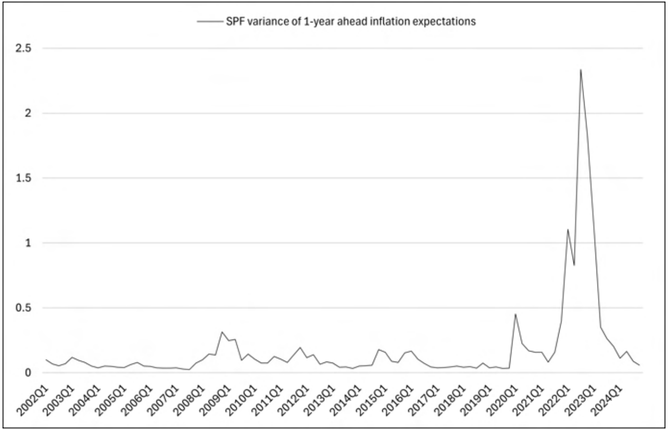
Contents

Motivation

- Post-pandemic tightening cycles have been characterized by exceptionally low sacrifice ratios (Ascari et al. (2025), Forbes et al. (2025), Zlobins (2025))
- Large cost-push shocks acted as inflation accelerators via increased frequency of price changes (Blanco et al. (2024), Cavallo et al. (2023), Dedola et al. (2024)) (repricing frequency $\uparrow \Rightarrow$ slope of the Phillips curve $\uparrow \Rightarrow$ sacrifice ratio $\downarrow$)
- While long-term inflation expectations remained anchored during the inflation surge, short-run expectations became more volatile, amplifying the initial impulse via wage (Blanchard and Bernanke (2023), Arce et al. (2024)) and price setting (Coibion and Gorodnichenko (2025))

Motivation (2)

- Besides, not only the *mean* of short-run expectations rose during the inflation surge, but also the *variance*, i.e. disagreement about the future path of inflation

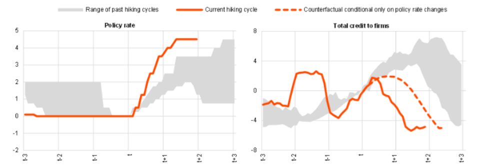


Motivation (3)

- An aggressive monetary tightening was required to limit the contagion from short-run expectations into beliefs about the long-run inflation ⇒ Some evidence that post-pandemic rate hikes were forcefully transmitted to financial conditions (see also Conti et al. (2024))

Chart 16: Monetary policy transmission across hiking cycles

(x-axis: years; y-axis: cumulative changes in percentage points for the policy rate, and credit growth in deviation from the start of the cycle (t) in percentage points for total credit to firms)



Sources: ECB (BSI, CSEC) and ECB calculations.
Notes: The relevant policy rate is the Deutsche Bundesbank's Lombard rate up to December 1998, the ECB's main refinancing operations rate up to May 2014 and the ECB's deposit facility rate thereafter. Total credit covers loans and debt securities. Monetary financial institutions loans are adjusted for sales and securitisation and cash pooling. The starting months correspond to the month immediately preceding the cycle's first hike or the explicit announcement of the hike. Hiking cycles are considered to have begun in: June 1988, October 1999, November 2005 and May 2022. The dotted line shows a counterfactual for lending volumes, taking December 2021 as the latest observation and projecting volumes conditional on the path of monetary policy rates based on the BVAR model in Altavilla, C., Giannone, D., and Lenza, M. (2016), "The Financial and Macroeconomic Effects of the OMT Announcements", International Journal of Central Banking, Vol. 12, No 3, pp 29-57. The latest observations are for March 2024 for total credit to firms and for April 2024 for the policy rate.

Source: Lane (2024)

Executive summary

- This paper:
  - Documents the strength of several monetary policy transmission channels to pin down the factors which contributed to a favourable stabilisation trade-off in the post-pandemic environment
  - Determines whether the systematic response of monetary policy to aggregate shocks has changed over time
  - Studies alternative monetary policy strategies in response to short-run inflation expectations shocks
- Main findings:
  - Inflation expectations became more responsive to MP shocks during the post-pandemic tightening cycle, playing a key role in delivering a soft landing
  - Sharp tightening of financial conditions also contributed to disinflation, but this was driven by more reactive systematic component of monetary policy to supply shocks
  - However, post-pandemic supply shocks were not typical as they infiltrated inflation expectations and were further amplified by the countercyclical response of profits
  - Model simulations suggest that disturbances to inflation expectations require an aggressive monetary policy response, especially if the central bank initially attempts to look through the shock

Contents

Empirical framework

- Structural vector autoregression with time-varying parameters and stochastic volatility (TVP-SVAR-SV) serves as our empirical laboratory
  - Estimated using the sparse matrix approach of Chan and Jeliazkov (2009) over the period from Q1 2002 to Q3 2023
  - See Econometric framework for more details)
- The benchmark model used to pin down the effects of discretionary monetary policy shock consists of five variables: Real GDP, HICP inflation, 3-month EURIBOR, Euro Stoxx 50 and EUR/USD exchange rate (Baseline results)
- Additional variables are added to evaluate the strength of several transmission channels over time:

Expectations	Financial
SPF 1, 2 and 5-year ahead inflation expectations	Lending volumes and rates to NFCs and HHs
SPF variance of 1 and 5-year ahead inflation forecasts	BLS credit standards for NFCs and HHs
ILS 1y1y and 5y5y inflation expectations	Deposit rate spread with 3-month EURIBOR for NFCs and HHs (agreed maturity)
	Residential property prices

Identification

- Identification of exogenous MP shock is done via mixture of high frequency information with narrative sign restrictions as in Zlobins (2022) (see ▸ HFI + NSR for details on the identification strategy)
- The obtained shock series is then plugged directly into the SVAR, following the "internal instrument" VAR literature (Romer and Romer (2004), Ramey (2011), Barakchian and Crowe (2013), Plagborg-Møller and Wolf (2021))
  - IRFs to the policy shock are then generated via Cholesky decomposition by ordering the shock series first
- In addition to transmission of discretionary MP disturbances, we look at the systematic response of MP to key macroeconomic shocks over time

Identification (2)

- In particular, we utilize sign and zero restrictions of Arias et al. (2018) to determine systematic response to aggregate demand, supply and oil supply shocks:

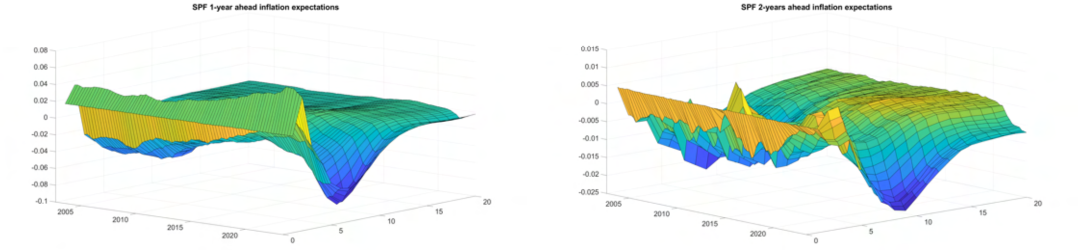
Shock	Real GDP	HICP inflation	3-month EURIBOR	Brent oil price
Aggregate demand	-	-	-	
Aggregate supply	-	+		0
Monetary policy	-	-	+	0
Oil supply	-	+		+

- All restrictions are imposed to hold on impact only

Contents

Transmission of discretionary monetary policy

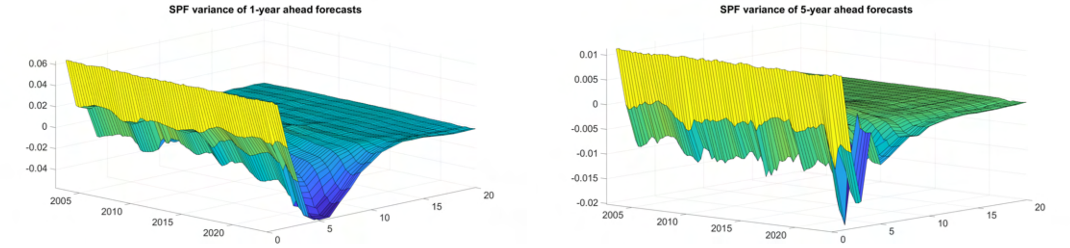
Forceful monetary policy response contained an up-side deanchoring of inflation expectations...



Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

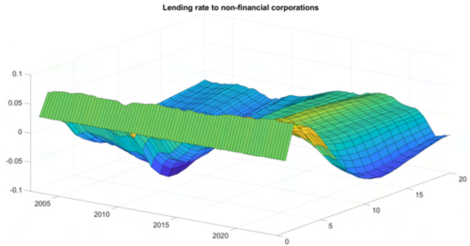
▸ SPF 5-year expectations ▸ Market-based expectations

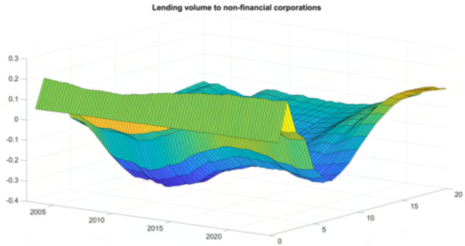
… and lowered disagreement about the future path of inflation



Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

Transmission to firms' financial conditions has been broadly in line with the past experience...





Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

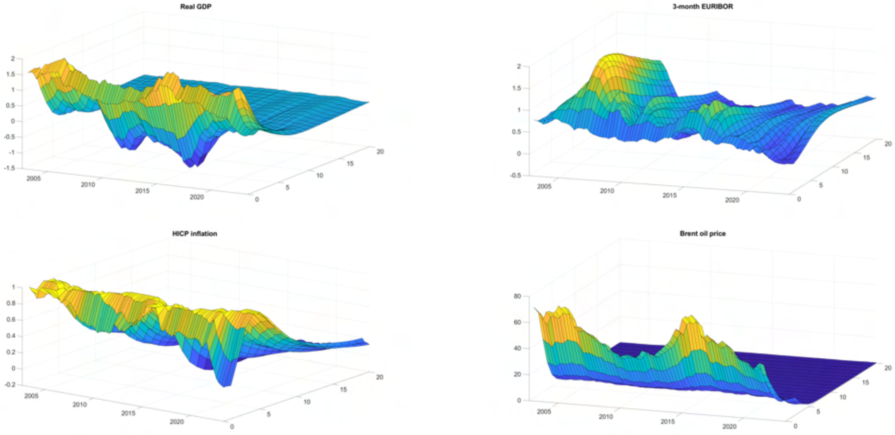
...while the impact on mortgages has been somewhat weaker, thus generating only transitory effect on house prices

Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

▸ BLS credit standards ▸ Deposit channel

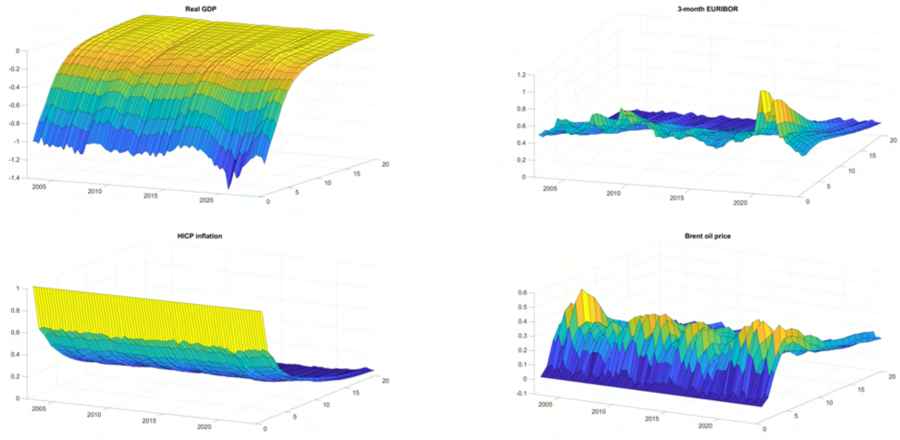
Transmission of systematic monetary policy

Systematic response to demand shocks has been increasingly more inertial...



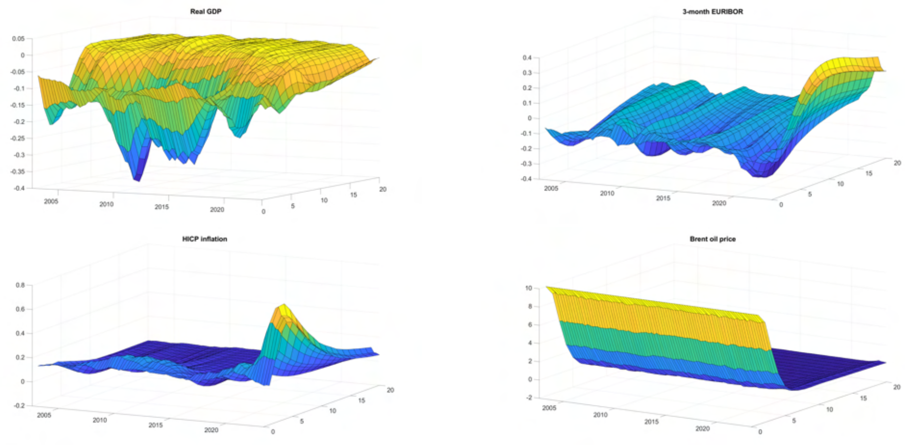
Notes: Figures show impulse response functions from the TVP-SVAR-SV to an aggregate demand shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 1 pp peak increase in HICP inflation in each period, allowing the estimated elasticities to be comparable over time.

...but monetary policy has become more reactive to supply-side disturbances...



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an aggregate supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 1 pp peak increase in HICP inflation in each period, allowing the estimated elasticities to be comparable over time.

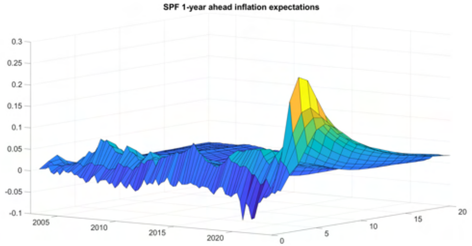
...especially those related to energy prices...



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

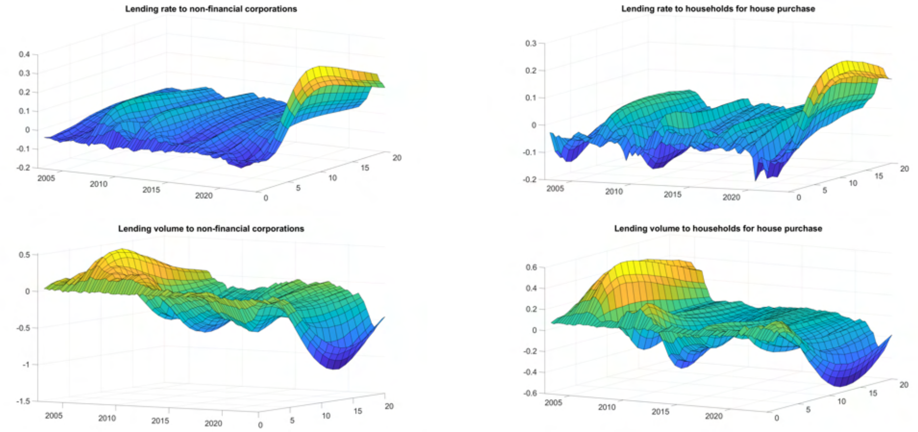
▸ Wu and Xia (2017) shadow rate ▸ Krippner (2014) shadow rate ▸ IRFs to HF oil supply shock of Känzig (2021)

...since they infiltrated inflation expectations and were further amplified by the countercyclical response of profits



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

More responsive systematic component explains the strong response of financial conditions in the recent tightening cycle



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

Contents

Structural framework

- In order to rationalize the role of short-run inflation expectations during the recent inflation surge, we deploy a medium-scale New Keynesian DSGE model of Sims and Wu (2021), calibrated to the euro area as in Grüning and Zlobins (2023)
- Features most of the relevant nominal and real rigidities
  - Retail firms set prices according to a variant of Calvo (1983) price contracts
  - Wages are also determined via staggered, Calvo-style wage contracts
  - Representative household obtains utility from consumption, subject to habit formation, and dis-utility from supplying labour
  - Final output is produced by representative wholesale firm, using capital and labor, subject to utilization adjustment costs and loan-in-advance constraint
  - Capital production subject to investment adjustment costs

Monetary policy

- Conventional monetary policy is implemented via standard Taylor rule with interest rate smoothing:

$$lnR_t^{TR} = (1-\rho_r)lnR^{TR} + \rho_r lnR_{t-1}^{TR} + (1-\rho_r)[\phi_\pi(ln\Pi_t - ln\Pi) + \phi_y(lnY_t - lnY_{t-1})] + s_r\varepsilon_{r,t} \quad (1)$$

  where:
  - ρ_r is the parameter governing interest rate inertia
  - ϕ_π and ϕ_y are parameters relating the policy rate's response to inflation and output growth deviation respectively
- In the baseline Calibration, these parameters are set to match standard values from the literature:
  - $\rho_r = 0.7$
  - $\phi_\pi = 1.5$
  - $\phi_y = 0.1$

A shock to (short-run) inflation expectations

- We slightly depart from the standard rational expectations assumption in their formation process by allowing expectations to be influenced by shocks as in Ascari et al. (2023), i.e. introduce bounded rationality:

$$\pi_t^{exp} = \pi_{t+1} + e_t^{\pi} \tag{2}$$

  where π_{t+1} is the rational expectation of next period inflation at time t and e_t^{π} is an exogenous process that allows expectation formation to drift from rational expectations solution

- The shock process evolves as an AR(1) process:

$$e_t^{\pi} = \rho_{e^{\pi}} e_{t-1}^{\pi} + \sigma_{e^{\pi}} \epsilon_t^{\pi} \tag{3}$$

  where $\rho_{e^{\pi}}$ is the persistence, $\sigma_{e^{\pi}}$ is the standard deviation of $\epsilon_t^{\pi} \sim \mathcal{N}(0,1)$ – an i.i.d. inflation expectation shock

Endogenous uncertainty

- Ascari et al. (2023) show that uncertainty substantially amplifies the effects of expectational shocks and help match the model-based IRFs with empirical evidence from the US (see ▸ Empirical evidence for the EA)
- Thus, we introduce endogenous uncertainty in our NK setup as follows
- First, we modify the shock process for intertemporal preference to capture second moment disturbances, i.e. both level and volatility as in Basu and Bundick (2017):

$$ln\psi_t^c = \rho_c ln\psi_{t-1}^c + \sigma_t^c \epsilon_t^c \tag{4}$$

$$ln\sigma_t^c = (1-\rho_{\sigma^c}) ln(\sigma^c) + \rho_{\sigma^c} ln(\sigma_{t-1}^c) + \sigma^{\sigma^c} \epsilon_t^{\sigma^c} \tag{5}$$

where ρ_c is the persistence of first moment shock, while ρ_{σ^c} and σ^{σ^c} govern the persistence and standard deviation of second moment shock respectively and σ^c is a steady-state level of volatility

Endogenous uncertainty (2)

- Second, output and inflation uncertainty is defined as the heteroscedastic response of of the respective variable, following Jurado et al. (2015), Basu and Bundick (2017) and Mumtaz and Theodoridis (2020):

$$\tilde{\sigma}_{x,t} = 100 ln(\frac{\sigma_{x,t}}{\sigma_x}) \tag{6}$$

where

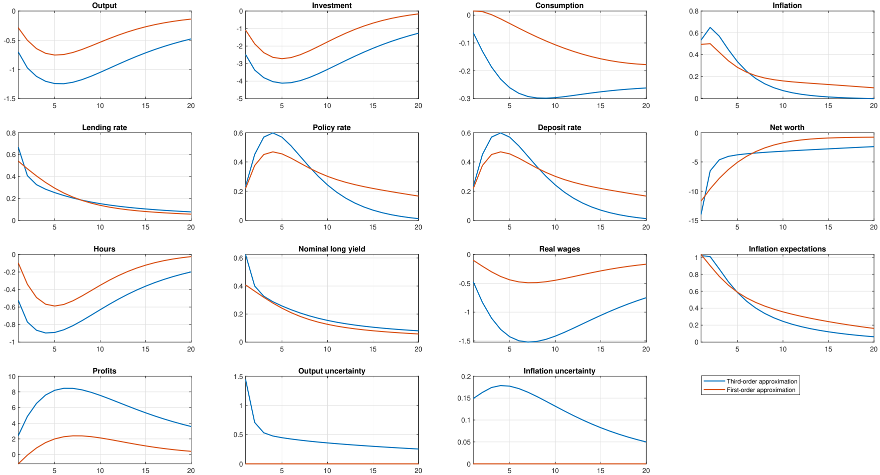
$$\sigma_{x,t} = var_t(x_t) = E_t(x_{t+1} - E_t x_{t+1})^2 \tag{7}$$

and σ_x is the stochastic standard deviation of the variable x_t

Simulations

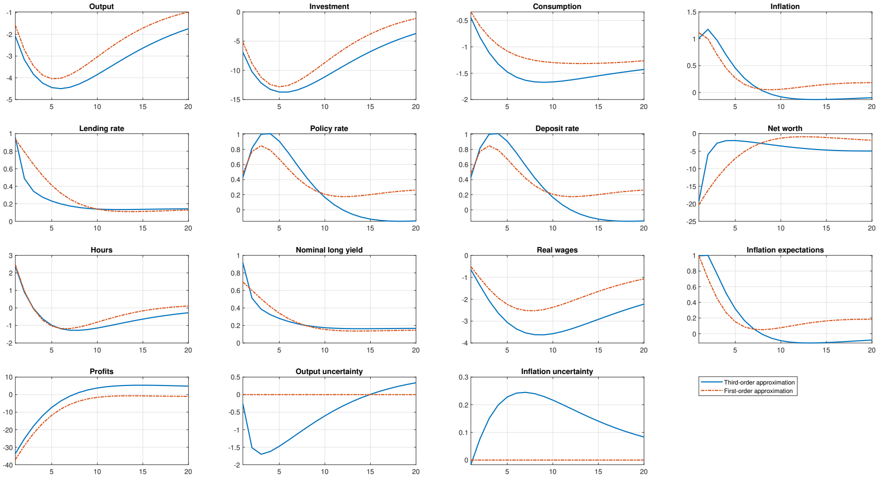
- IRFs to short-run inflation expectation shocks are derived via third-order solution of the model
  - For robustness, also using the first-order approximation of the same model $\Rightarrow$ Allows to measure the contribution of endogenous uncertainty
- We then study monetary policy strategies in response to inflation expectations shock:
  - First, we assume that the central bank takes more aggressive anti-inflationary stance ($\phi_\pi = 2.74$ as in NAWM II (Coenen et al. (2017)))
  - Second, we consider the case in which the monetary authority initially attempts to look through the shock, both w/ and w/o higher weight on inflation stabilization (we feed in expansionary MP shocks in the first four quarters to off-set the systematic component)
  - Finally, we assess the impact of more flexible price setting – a well documented feature of the recent inflation surge – on the stabilisation trade-off ($\phi_p = 0.75$, implying average duration of Calvo contracts equal to four quarters)

Endogenous uncertainty substantially amplifies the propagation of inflation expectations shock...



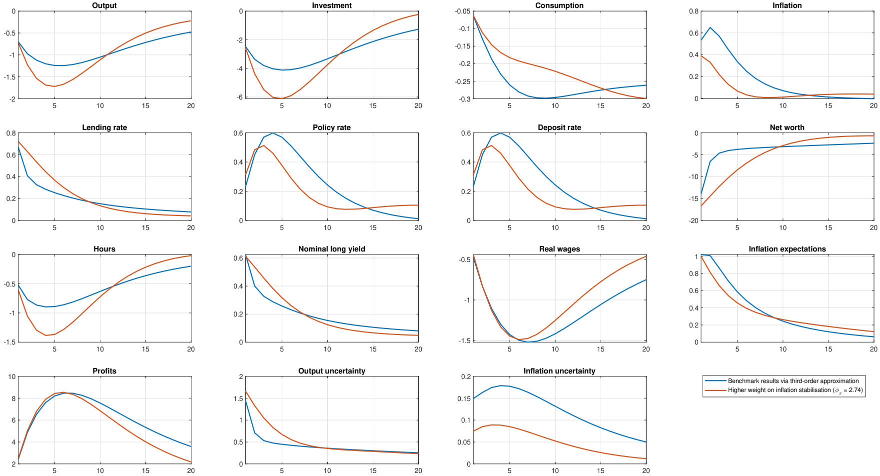
Notes: Figures show impulse response functions to an inflation expectations shock. The shock has been normalized to a 1 pp increase in inflation expectations.

… while it's impact on the transmission of a typical supply shock is muted



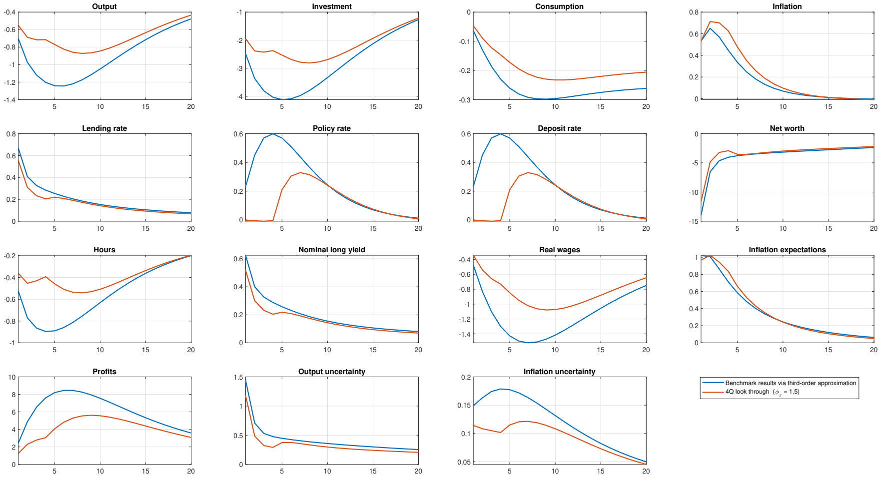
Notes: Figures show impulse response functions to a productivity shock. The shock has been normalized to a 1 pp increase in inflation.

Aggressive MP response can effectively reduce deanchoring of expectations, at the cost of higher output loss...



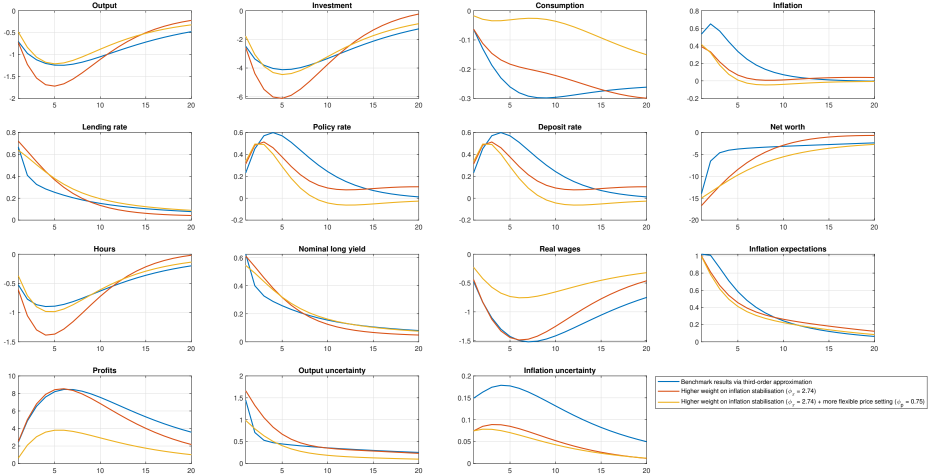
Notes: Figures show impulse response functions to an inflation expectations shock. The shock has been normalized to a 1 pp increase in inflation expectations.

… on the other hand, attempts to look through such shock can lead to more inflationary outcomes…



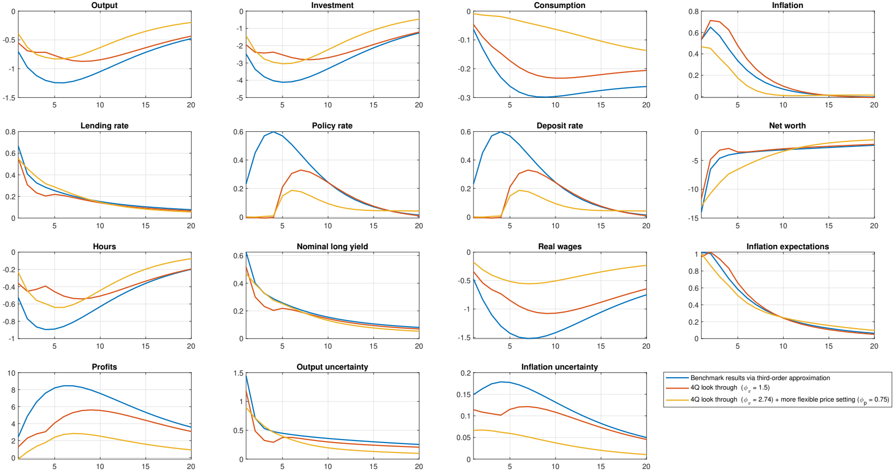
Notes: Figures show impulse response functions to an inflation expectations shock. The shock has been normalized to a 1 pp increase in inflation expectations.

However, more flexible price-setting reduces the stabilisation trade-off...



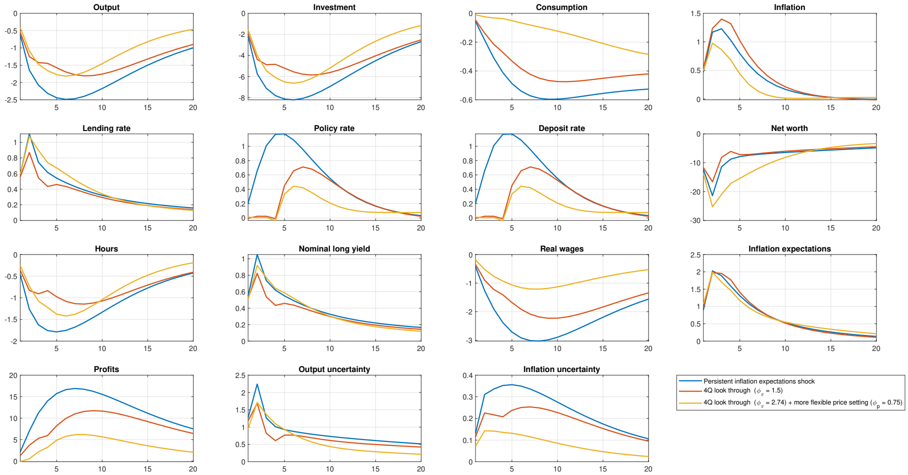
Notes: Figures show impulse response functions to an inflation expectations shock. The shock has been normalized to a 1 pp increase in inflation expectations.

... even if the central bank doesn't respond to the initial shock but then aggressively reigns in inflationary deviations...



Notes: Figures show impulse response functions to an inflation expectations shock. The shock has been normalized to a 1 pp increase in inflation expectations.

… regardless of the shock's persistence



Notes: Figures show impulse response functions to an inflation expectations shock. The shock has been normalized to a 1 pp increase in inflation expectations.

Contents

Summary

- Re-anchoring channel has played a key role in delivering a soft landing
- Sharp tightening of financial conditions also contributed to disinflation, but this was driven by more responsive systematic component of monetary policy to supply shocks
- However, post-pandemic supply shocks were not typical as they infiltrated inflation expectations and were further amplified by the countercyclical response of profits
- Model simulations suggest that disturbances to inflation expectations require an aggressive monetary policy response, especially if the central bank initially attempts to look through the shock
  - More flexible price-setting can reduce the stabilisation trade-off

Contents

Empirical framework

- Structural vector autoregression with time-varying parameters and stochastic volatility (TVP-SVAR-SV) serves as our empirical laboratory:

$$y_t = C_t + A_1 y_{t-1} + ... + A_p y_{t-p} + \epsilon_t \tag{8}$$

  where C_t is an $n \times 1$ vector of constants, A_j ($j = 1, \ldots, p$) is an $n \times n$ array of coefficients related to the *j-th* lag and ϵ_t is an $n \times 1$ structural error vector with zero mean and variance-covariance matrix Σ_t
- For convenience, matrices of SVAR coefficients are stacked into vector:

$$\theta_t = (C_t^{'}, vec(A_{1,t})^{'}, ..., vec(A_{p,t})^{'}) \tag{9}$$

- The time variation of coefficients is then assumed to evolve according to a random walk process:

$$\theta_t = \theta_{t-1} + \upsilon_t \quad \upsilon_t \sim N(0, \Omega) \tag{10}$$

  where υ_t is a white noise vector with block-diagonal covariance matrix Ω

Empirical framework (2)

- Additionally, the error covariance matrix is rendered to be period-specific as follows:

$$\Sigma_t = F_t \Lambda_t F_t' \tag{11}$$

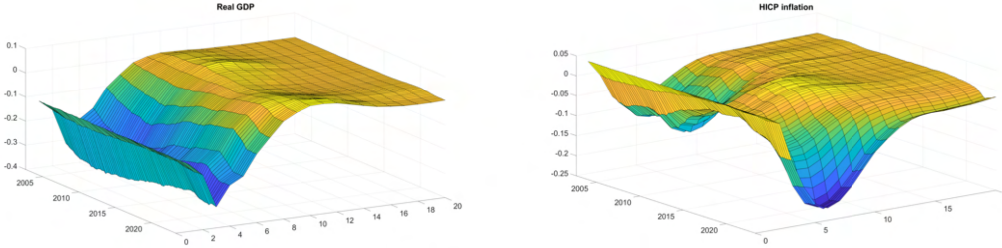
where F_t is a lower triangular matrix with a unit diagonal and Λ_t is a diagonal matrix with elements denoted by $\exp(\lambda_{i,t})$ and the log-volatilities $\lambda_{i,t}$ following the AR(1) process:

$$\lambda_{i,t} = \gamma \lambda_{i,t-1} + \nu_{i,t} \quad \nu_{i,t} \sim N(0, \phi_i\ ) \tag{12}$$

where γ is a persistence parameter set to 0.8 for all volatilities and $\nu_{i,t}$ is a white noise error with variance ϕ_i

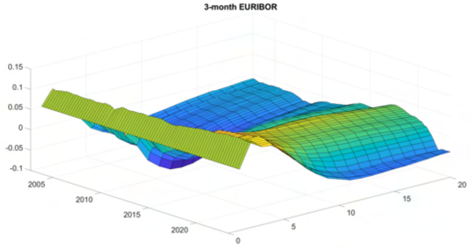
Back

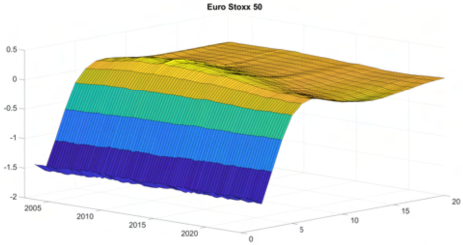
Baseline results



Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

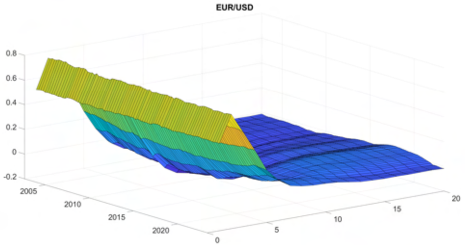
Baseline results (2)





Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

Baseline results (3)



Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

Back

Identification via HFI + narrative sign restrictions

- First, we gather high frequency reactions of interest rates and stock prices around the policy announcements from the EA Monetary policy Event Study Database (EA-MPD) of Altavilla et al. (2019)
  - We use both the press release (for conventional policy shocks) and press conference window (for all unconventional policy innovations)
- Then, we include high frequency surprises into the VAR and ensure that they do not depend on their own lags:

$$m_t = a_0 + \sum_{j=1}^{p} 0 \; m_{t-j} + \epsilon_t \tag{13}$$

- The VAR is estimated on a monthly basis with standard Bayesian techniques by specifying an independent Normal Wishart prior
  - We include data since January 2002 to October 2023
  - If several announcements take place during month t, the surprises are summed up as in Andrade and Ferroni (2021), Kerssenfischer (2019)

Identification via HFI + narrative sign restrictions (2)

- In the second step, we apply the following identifying restrictions:

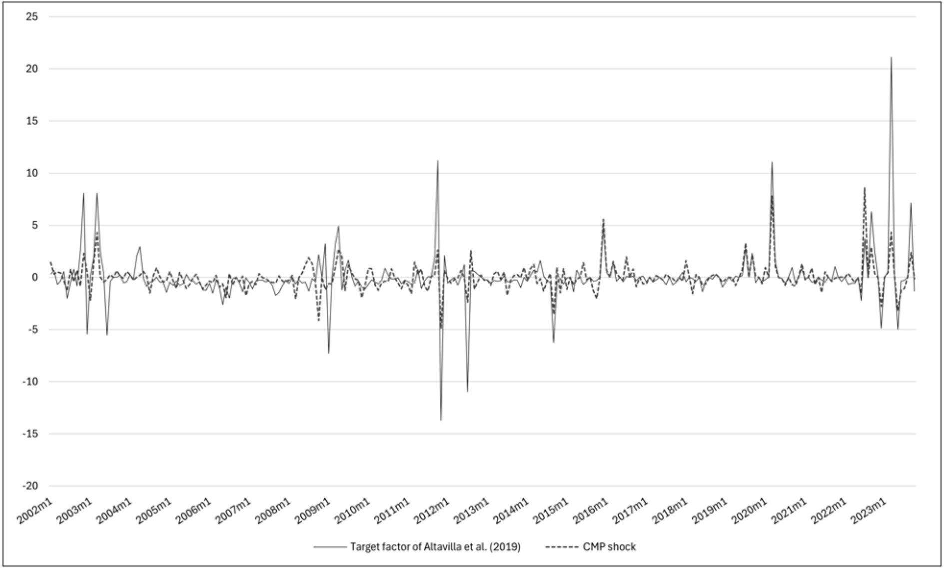
Shock	3-month OIS (press release)	3-month OIS (press conference)	1-year OIS	10-year OIS	10-year IT	Euro Stoxx 50
CMP	-					+
NIRP		-				+
FG			-			+
QE				-	-	+
MS-QE				+	-	+
Information		-	-	-		-

- All restrictions are imposed to hold on impact only
- Additionally, we augment traditional sign restrictions with narrative information about the respective shocks, using the approach of Antolín-Díaz and Rubio-Ramírez (2018)
- In essence, this information is implemented by placing restrictions on the structural disturbances and historical decompositions for key historical events, sharpening the inference

Identification via HFI + narrative sign restrictions (3)

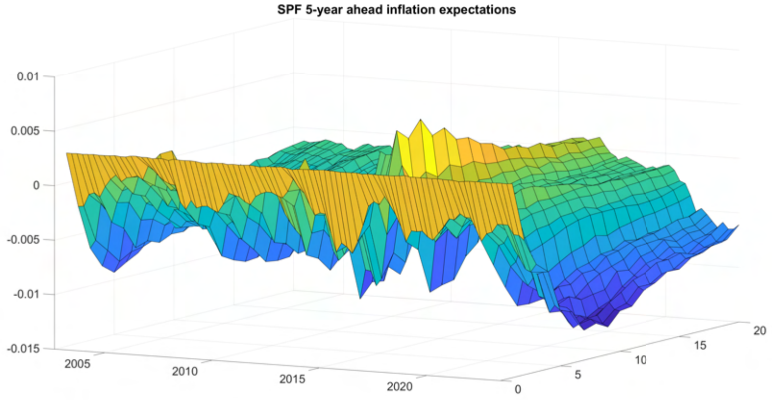
- We use the following narrative restrictions to tell apart the effects of different monetary policy measures:
  - **Narrative Sign Restriction I.** *An expansionary CMP shock took place in November 2011.*
  - **Narrative Sign Restriction II.** *For November 2011, the CMP shock was the overwhelming driver of the unexpected movement in 3-month OIS (press release window).*
  - **Narrative Sign Restriction III.** *An expansionary NIRP shock took place in June 2014.*
  - **Narrative Sign Restriction IV.** *For June 2014, the NIRP shock was the overwhelming driver of the unexpected movement in 3-month OIS (press conference window).*
  - **Narrative Sign Restriction V.** *An expansionary FG shock took place in July 2013.*
  - **Narrative Sign Restriction VI.** *For July 2013, the FG shock was the overwhelming driver of the unexpected movement in 1-year OIS.*
  - **Narrative Sign Restriction VII.** *An expansionary QE shock took place in January 2015.*
  - **Narrative Sign Restriction VIII.** *For January 2015, the QE shock was the overwhelming driver of the unexpected movement in 10-year OIS.*
  - **Narrative Sign Restriction IX.** *An expansionary market-stabilization QE shock took place in September 2012.*
  - **Narrative Sign Restriction X.** *For September 2012, the market-stabilization QE shock was the overwhelming driver of the unexpected movement in 10-year Italian yield.*

Comparison of shock series



▸ Back

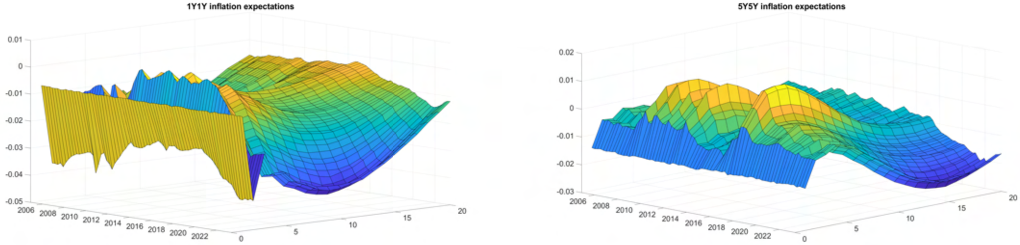
Forceful monetary policy response contained an up-side deanchoring of inflation expectations (2)



Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

Back

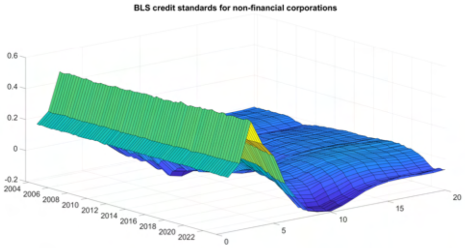
Results are robust to using market-based expectations

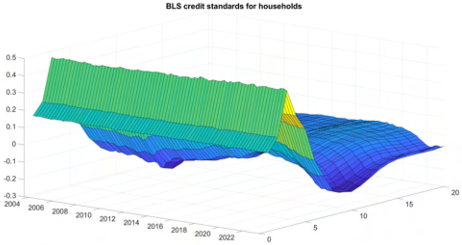


Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q4 2004 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

▸ Back

Results for bank lending standards

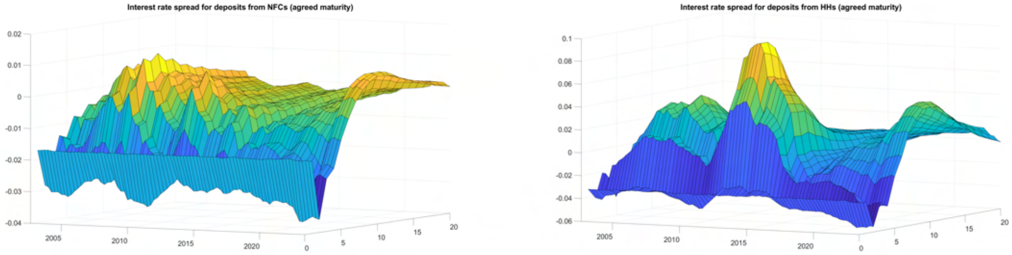




Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2003 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

▸ Back

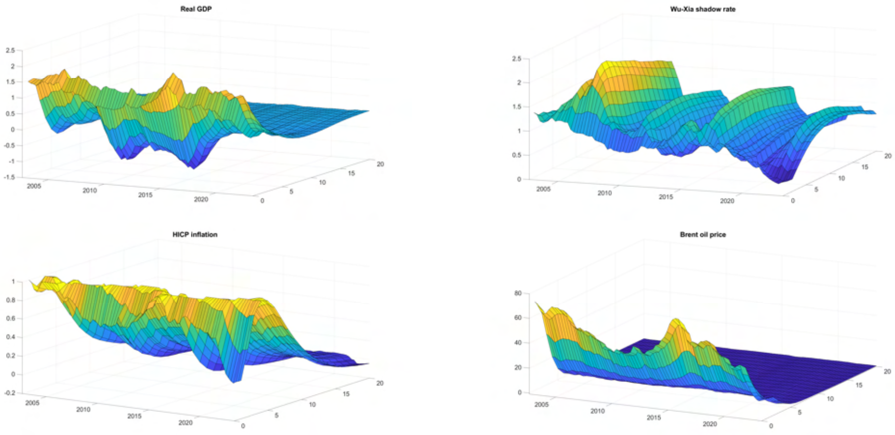
...transmission via the deposit channel also subdued, especially initially & for HHs



Notes: Figures show impulse response functions from the TVP-SVAR-SV to the CMP shock over period from Q3 2002 to Q3 2023. The shock has been normalized to a 5 bp increase in the 3-month EURIBOR in each period, allowing the estimated elasticities to be comparable over time.

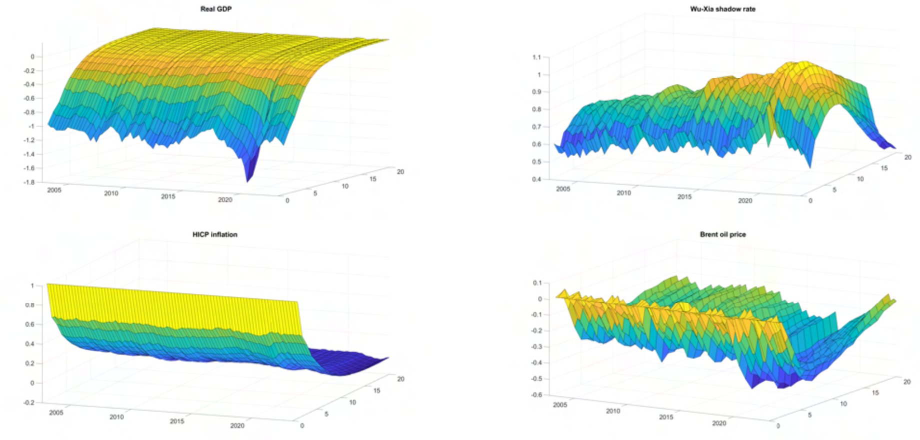
Back

IRFs to an aggregate demand shock w/ Wu and Xia (2017) shadow rate



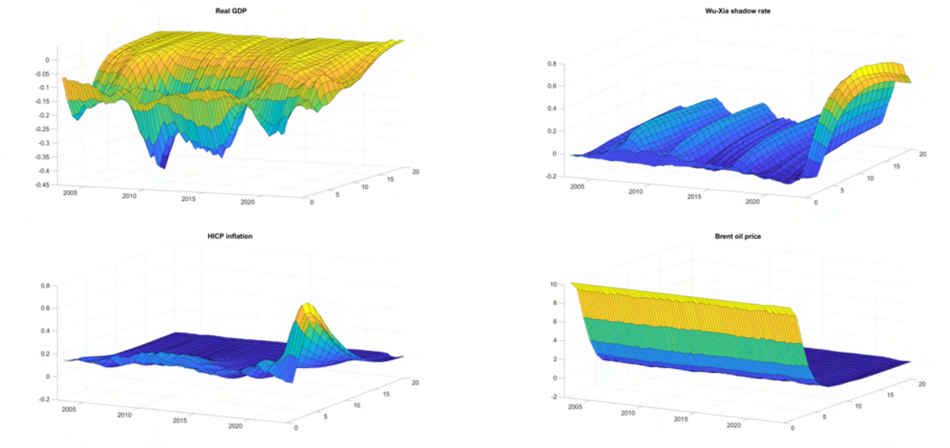
Notes: Figures show impulse response functions from the TVP-SVAR-SV to an aggregate demand shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 1 pp peak increase in HICP inflation in each period, allowing the estimated elasticities to be comparable over time.

IRFs to an aggregate supply shock w/ Wu and Xia (2017) shadow rate



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an aggregate supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 1 pp peak increase in HICP inflation in each period, allowing the estimated elasticities to be comparable over time.

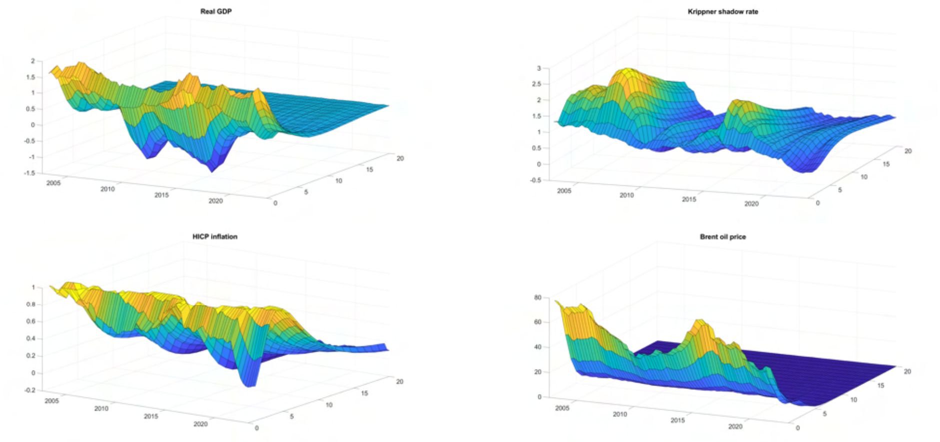
IRFs to an oil supply shock w/ Wu and Xia (2017) shadow rate



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

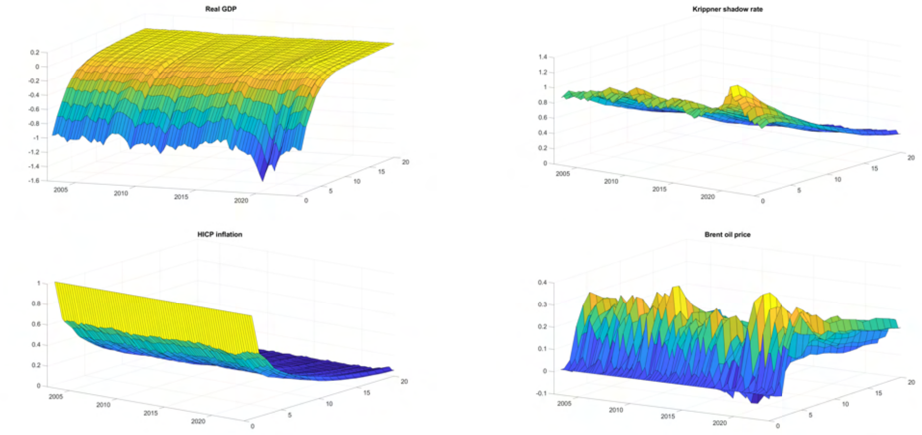
Back

IRFs to an aggregate demand shock w/ Krippner (2014) shadow rate



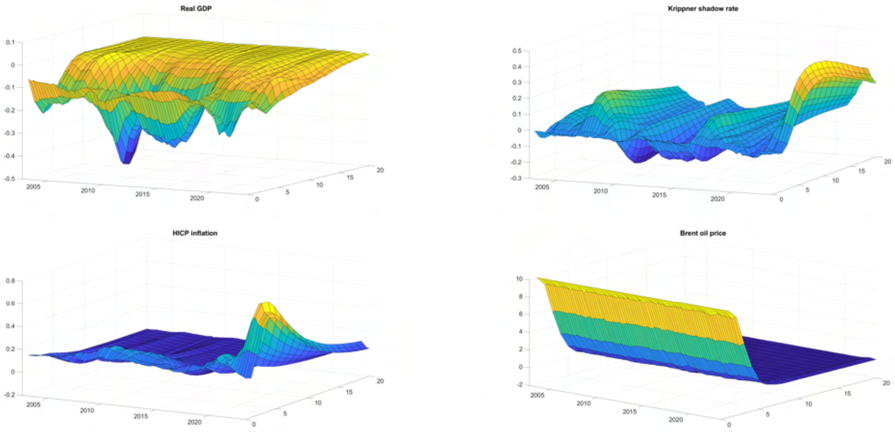
Notes: Figures show impulse response functions from the TVP-SVAR-SV to an aggregate demand shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 1 pp peak increase in HICP inflation in each period, allowing the estimated elasticities to be comparable over time.

IRFs to an aggregate supply shock w/ Krippner (2014) shadow rate



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an aggregate supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 1 pp peak increase in HICP inflation in each period, allowing the estimated elasticities to be comparable over time.

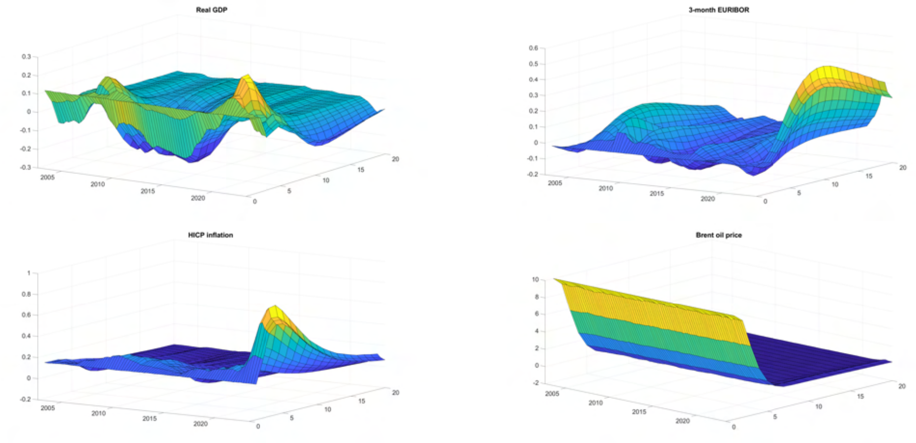
IRFs to an oil supply shock w/ Krippner (2014) shadow rate



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply shock, identified via sign and zero restrictions. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

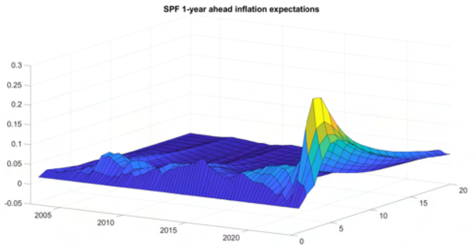
Back

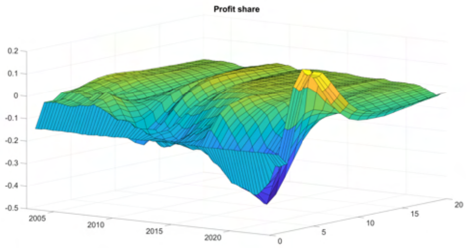
IRFs to an oil supply news shock of Känzig (2021)



Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply news shock of Känzig (2021). IRFs have been generated via the internal instrument approach by ordering the shock series first. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

IRFs to an oil supply news shock of Känzig (2021) (2)





Notes: Figures show impulse response functions from the TVP-SVAR-SV to an oil supply news shock of Känzig (2021). IRFs have been generated via the internal instrument approach by ordering the shock series first. The shock has been normalized to lead to a 10 pp peak increase in Brent oil price in each period, allowing the estimated elasticities to be comparable over time.

Back

Empirical evidence of the effects of inflation expectation shocks in the euro area

- In order to benchmark model-based results, we deploy fixed-parameter SVAR with stochastic volatility:

$$y_t = C_t + A_1 y_{t-1} + ... + A_p y_{t-p} + \epsilon_t \quad (14)$$

where C_t is an $n \times 1$ vector of constants, A_j (j =1, . . . , p) is an $n \times n$ array of coefficients related to the j-th lag and ϵ_t is an $n \times 1$ structural error vector with zero mean and variance-covariance matrix Σ_t

- Stochastic volatility is specified as follows:

$$\Sigma_t = F_t \Lambda_t F_t' \quad (15)$$

where F_t is a lower triangular matrix with a unit diagonal and Λ_t is a diagonal matrix with elements denoted by $\exp(\lambda_{i,t})$ and the log-volatilities $\lambda_{i,t}$ following the AR(1) process:

$$\lambda_{i,t} = \gamma_i \lambda_{i,t-1} + \nu_{i,t} \qquad \nu_{i,t} \sim N(0, \phi_i\ ) \quad (16)$$

Empirical evidence of the effects of inflation expectation shocks in the euro area (2)

- Contrary to the approach used in the estimation of the TVP-SVAR-SV, in this case γ_i is treated as a variable-specific endogenous variable, which is estimated from the data as in Jacquier et al. (1994)
- The prior for γ_i follows a normal distribution:

$$\pi(\gamma_i) \sim N(\gamma_0, \zeta_0) \tag{17}$$

- The prior is specified to be non-informative by setting the prior mean $\gamma_0 = 0$ with large variance $\zeta_0 = 1000$

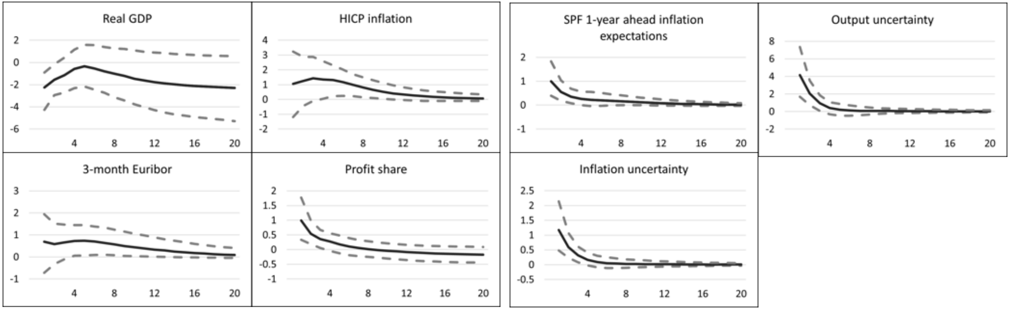
Empirical evidence of the effects of inflation expectation shocks in the euro area (3)

- Inflation expectations shock is identified in the spirit of Ascari et al. (2023):

Variable	Inflation expectations shock	Aggregate supply shock
Real GDP	-	-
HICP inflation		+
3-month EURIBOR		
Profit share	+	-
SPF 1-year ahead inflation expectations	+	
SPF variance of GDP forecasts	+	-
SPF variance of inflation forecasts	+	+

- All restrictions are imposed to hold on impact only

Empirical evidence of the effects of inflation expectation shocks in the euro area (4)



Note: Figures show impulse response functions from the Bayesian SVAR-SV to an inflation expectations shock, normalized to generate a 1 pp increase in the SPF 1-year ahead inflation expectations. The solid line shows the median response while the dashed region denotes the 68% credible sets.

Back

Calibration

Symbol	Description	Parameter value
	Household sector and labour markets	
β	Time discount factor	0.998
b	Internal habit formation	0.82
η	Inverse Frisch labour elasticity	2
χ	Labour disutility scaling parameter	$L = 1$
ϵ_w	Elasticity of substitution for labour types	11
ϕ_w	One minus probability to reset wage	0.78
γ_w	Wage indexation	0.37
	Production sector and price rigidity	
α	Physical capital share	0.36
δ_0	Steady-state capital depreciation rate	0.025
δ_1	Capital utilisation linear term	$u = 1$
δ_2	Capital utilisation quadratic term	0.01
κ_I	Investment adjustment cost parameter	2
Π	Steady-state gross inflation	1.00475
ϵ_p	Elasticity of substitution for intermediate goods	11
ϕ_p	One minus probability to reset price	0.82
γ_p	Price indexation	0.23

Calibration (2)

Symbol	Description	Parameter value
	Fiscal authority	
$\bar{b}_G$	Steady-state government debt	$B_G Q_B/(4Y) = 0.80$
G	Steady-state government spending	$G/Y = 0.204$
	Financial sector and central bank	
κ	Coupon decay parameter	$1 - 40^{-1}$
ψ	Fraction of investment financed by debt	0.50
σ	Financial intermediary survival probability	0.95
θ	General absconding rate	$400(R^F - R) = 3$
X	New financial intermediary start-up fund	Leverage $= 4.6$
Δ	Public bond relative absconding rate	2/3
ρ_r	Interest rate smoothing in Taylor rule	0.7
ϕ_π	Inflation gap parameter in Taylor rule	1.5
ϕ_y	Output gap parameter in Taylor rule	0.10
s_r	Volatility of monetary policy shocks	0.0025
b_{cb}	Steady-state CB holdings of public bonds	0.1733
f_{cb}	Steady-state CB holdings of private bonds	0.0382

Calibration (3)

Symbol	Description	Parameter value
	Shock processes	
ρ_A	AR(1) persistence of productivity shocks	0.9
s_A	Volatility of productivity shocks	0.005
ρ_{e^π}	AR(1) persistence of inflation expectation shocks	0.9
σ_{e^π}	Volatility of inflation expectation shocks	0.005
ρ_c	AR(1) persistence of first moment preference shock	0.9
ρ_{σ^c}	AR(1) persistence of second moment preference shock	0.9
σ^{σ^c}	Volatility of second moment preference shock	0.005
σ^c	Steady-state volatility of preference shock	0.0065
ρ_G	AR(1) persistence of government spending shocks	0.95
s_G	Volatility of government spending shocks	0.0035
ρ_t	AR(1) persistence of liquidity shocks	0.98
s_t	Volatility of liquidity shocks	0.04
ρ_b	AR(1) persistence of public bond QE	1
ρ_f	AR(1) persistence of private bond QE	1

Back

Bibliography I

Altavilla, C., L. Brugnolini, R. S. Gürkaynak, R. Motto, and G. Ragusa (2019). Measuring euro area monetary policy. Journal of Monetary Economics 108, 162–179.

Andrade, P. and F. Ferroni (2021). Delphic and Odyssean Monetary Policy Shocks: Evidence from the Euro Area. Journal of Monetary Economics 117, 816–832.

Antolín-Díaz, J. and J. F. Rubio-Ramírez (2018). Narrative Sign Restrictions for SVARs. American Economic Review 108(10), 2802–2829.

Arce, O., M. Ciccarelli, C. Montes-Galdón, and A. Kornprobst (2024). What caused the euro area post-pandemic inflation? Occasional Paper Series No. 343, European Central Bank.

Arias, J. E., J. F. Rubio-Ramirez, and D. F. Waggoner (2018). Inference Based on Structural Vector Autoregressions Identified with Sign and Zero Restrictions: Theory and Applications. Econometrica 86(2), 685—-720.

Ascari, G., A. Carrier, E. Gasteiger, A. Grimaud, and G. Vermandel (2025). Monetary policy in the Euro Area: When the Phillips curves ... are curves. mimeo.

Ascari, G., S. Fasani, J. Grazzini, and L. Rossi (2023). Endogenous uncertainty and the macroeconomic impact of shocks to inflation expectations. Journal of Monetary Economics 140, 48–63.

Barakchian, M. S. and C. Crowe (2013). Monetary Policy Matters: Evidence From New Shocks Data. Journal of Monetary Economics 60(8), 950–966.

Basu, S. and B. Bundick (2017). Uncertainty Shocks in a Model of Effective Demand. Econometrica 85, 937–958.

Blanchard, O. J. and B. S. Bernanke (2023). What Caused the US Pandemic-Era Inflation? NBER Working Papers 31417, National Bureau of Economic Research, Inc.

Bibliography II

Blanco, A., C. Boar, C. J. Jones, and V. Midrigan (2024). The Inflation Accelerator. NBER Working Papers 32531, National Bureau of Economic Research, Inc.

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework. Journal of Monetary Economics 12(3), 383–398.

Cavallo, A., F. Lippi, and K. Miyahara (2023). Large Shocks Travel Fast. NBER Working Papers 31659.

Chan, J. and I. Jeliazkov (2009). Efficient Simulation and Integrated Likelihood Estimation in State Space Models. International Journal of Mathematical Modelling and Numerical Optimisation 1(1-2), 101–120.

Coenen, G., M. Ehrmann, G. Gaballo, P. Hoffmann, A. Nakov, S. Nardelli, E. Persson, and G. Strasser (2017). Communication of monetary policy in unconventional times. Working Paper No. 2080, European Central Bank.

Coibion, O. and Y. Gorodnichenko (2025). Inflation, Expectations and Monetary Policy: What Have We Learned and to What End? NBER Working Papers 33858, National Bureau of Economic Research, Inc.

Conti, A. M., S. Neri, and A. Notarpietro (2024). Credit strikes back: the macroeconomic impact of the 2022-23 ECB monetary tightening and the role of lending rates. Questioni di Economia e Finanza (Occasional Papers) No. 884, Bank of Italy, Economic Research and International Relations Area.

Dedola, L., L. Henkel, C. Höynck, C. Osbat, and S. Santoro (2024). What does new micro price evidence tell us about inflation dynamics and monetary policy transmission? Economic Bulletin Articles 3.

Forbes, K., J. Ha, and M. A. Kose (2025). Tradeoffs over Rate Cycles: Activity, Inflation, and the Price Level. In NBER Macroeconomics Annual 2025, volume 40, NBER Chapters. National Bureau of Economic Research, Inc.

Bibliography III

Grüning, P. and A. Zlobins (2023). Quantitative Tightening: Lessons from the US and Potential Implications for the EA. Working Papers 2023/09, Latvijas Banka.

Jacquier, E., N. G. Polson, and P. E. Rossi (1994). Bayesian Analysis of Stochastic Volatility Models. Journal of Business & Economic Statistics 12(4), 371–389.

Jurado, K., S. C. Ludvigson, and S. Ng (2015). Measuring Uncertainty. American Economic Review 105(3), 1177–1216.

Kerssenfischer, M. (2019). Information Effects of Euro Area Monetary Policy: New Evidence from High-Frequency Futures Data. Discussion Paper No. 07, Deutsche Bundesbank.

Krippner, L. (2014). Measuring the stance of monetary policy in conventional and unconventional environments. CAMA Working Papers 2014-06, Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, The Australian National University.

Känzig, D. R. (2021). The Macroeconomic Effects of Oil Supply News: Evidence from OPEC Announcements. American Economic Review 111(4), 1092–1125.

Lane, P. R. (2024). The analytics of the monetary policy tightening cycle. Guest lecture at Stanford Graduate School of Business. Available at: https://www.ecb.europa.eu/press/key/date/2024/html/ecb.sp240502~4066265c78.en.html.

Mumtaz, H. and K. Theodoridis (2020). Dynamic effects of monetary policy shocks on macroeconomic volatility. Journal of Monetary Economics 114, 262–282.

Bibliography IV

Plagborg-Møller, M. and C. K. Wolf (2021). Local Projections and VARs Estimate the Same Impulse Responses. Econometrica 89(2), 955–980.

Ramey, V. A. (2011). Identifying Government Spending Shocks: It's All in the Timing. The Quarterly Journal of Economics 126(1), 1–50.

Romer, C. D. and D. H. Romer (2004). A New Measure of Monetary Shocks: Derivation and Implications. American Economic Review 94(4), 1055–1084.

Sims, E. and E. Wu (2021). Evaluating central banks' tool kit: past, present, and future. Journal of Monetary Economics 118, 135–160.

Wu, J. C. and F. D. Xia (2017). Time-Varying Lower Bound of Interest Rates in Europe. Research Paper No. 17-06, Chicago Booth.

Zlobins, A. (2022). Into the Universe of Unconventional Monetary Policy: State-dependence, Interaction and Complementarities. Working Paper No. 5/2022, Latvijas Banka.

Zlobins, A. (2025). Monetary Policy Transmission in the Euro Area: Is this Time Different? Chapter I: Lags and Strength. Working Paper No. 1/2025, Latvijas Banka.