БЪЛГАРСКА НАРОДНА БАНКА BULGARIAN NATIONAL BANK

From Low to High Inflation: Regime Shifts and Economic Shock Transmission in Bulgaria

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Outline

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Literature review

- Inflation behaves differently in low- and high-inflation regimes (Borio et al., 2023)

Main characteristics of a **low-inflation environment**:

✓ Low inflation volatility

✓ Inflation driven by **sector-specific price** changes with minimal cross-sector correlation

✓ The **common component of price changes is small**, reducing the influence of inflation on decision-making

✓ Wages and prices are **loosely linked**

Theoretical Explanations:

- **Rational Inattention Hypothesis** (Sims): Agents ignore inflation signals due to low risks of large price changes
- **Price Stickiness** (Taylor): Lower incentives for frequent price updates due to low persistence of cost shocks
- **Downward Wage Rigidities** (Daly & Hobijn): In a low-inflation regime, wages resist downward adjustment, flattening the Phillips curve
- **Market Power & Inflation**: Increased consumer search intensity at low inflation reduces firms' ability to pass on cost increases

Literature review

Main characteristics of a **high-inflation environment**:

- ✓ Increased **inflation volatility**
- ✓ Inflation surpasses the “rational inattention zone” and becomes a **focus of attention**
- ✓ Price changes are **broad-based** across economic sectors and HICP groups
- ✓ Firms and workers adjust prices more frequently to **protect purchasing power and profit margins**
  - contract lengths become shorter (Devereux & Yetman, Alvarez et al.)
  - more inflation indexation clauses in contracts, amplifying inflation persistence
- ✓ Increased inflation volatility leads to heightened **economic uncertainty**
- ✓ Tighter **wage-price linkages**
- ✓ **Stronger cost pass-through:** Firms pass on cost increases to prices due to rising borrowing costs, heightened uncertainty and expected interest rate hikes

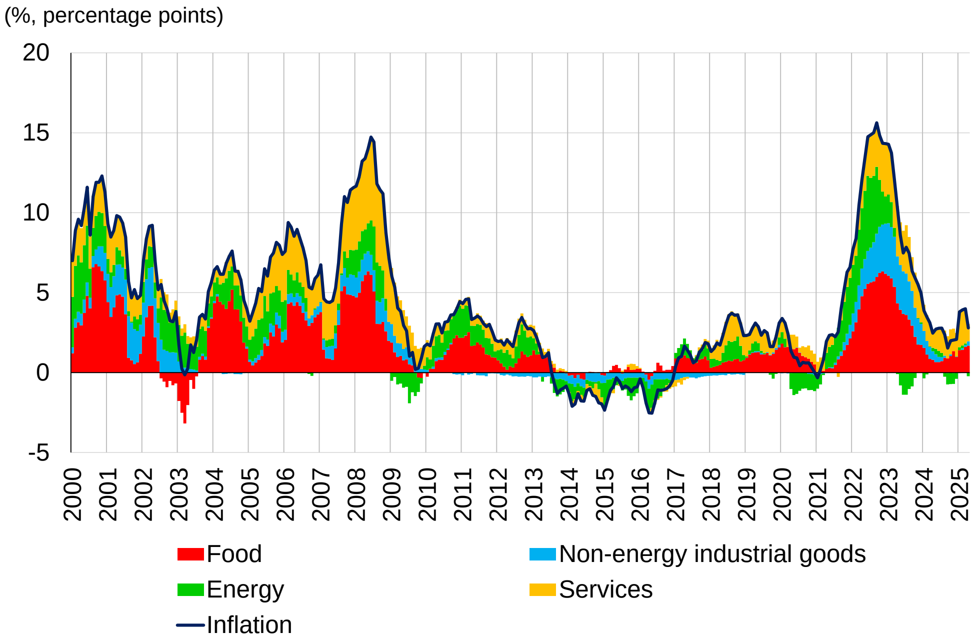
Outline

Stylized facts

- Several high-inflation episodes evident from Chart 1

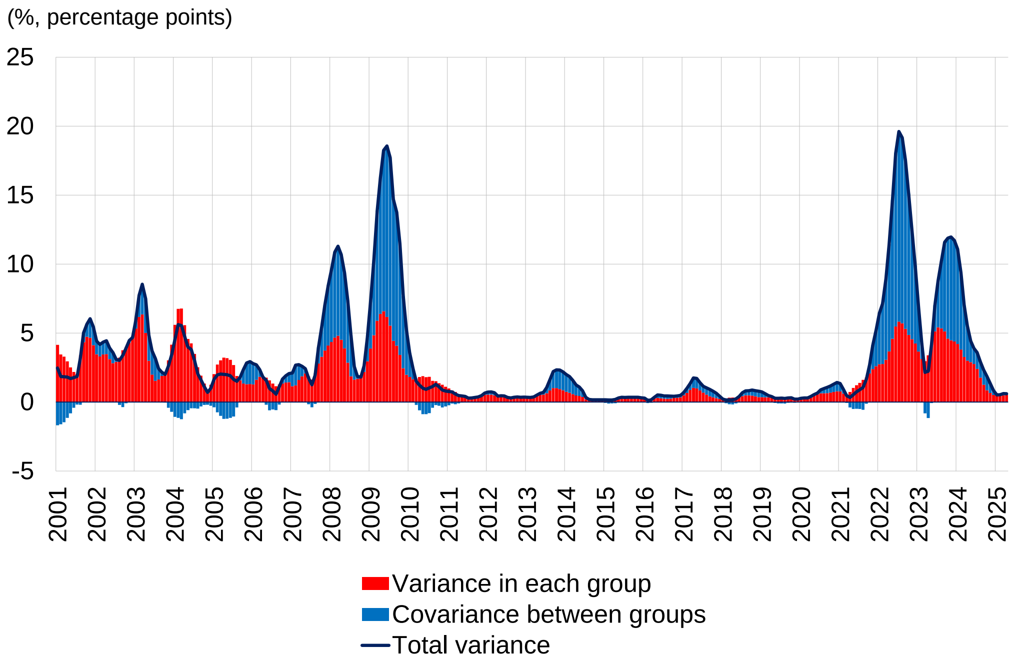
- Volatility increases in high-inflation regimes due to stronger price co-movements

Chart 1: Annual HICP inflation and main drivers



Source: Eurostat

Chart 2: Volatility (variance) of inflation



Source: Eurostat, own calculations

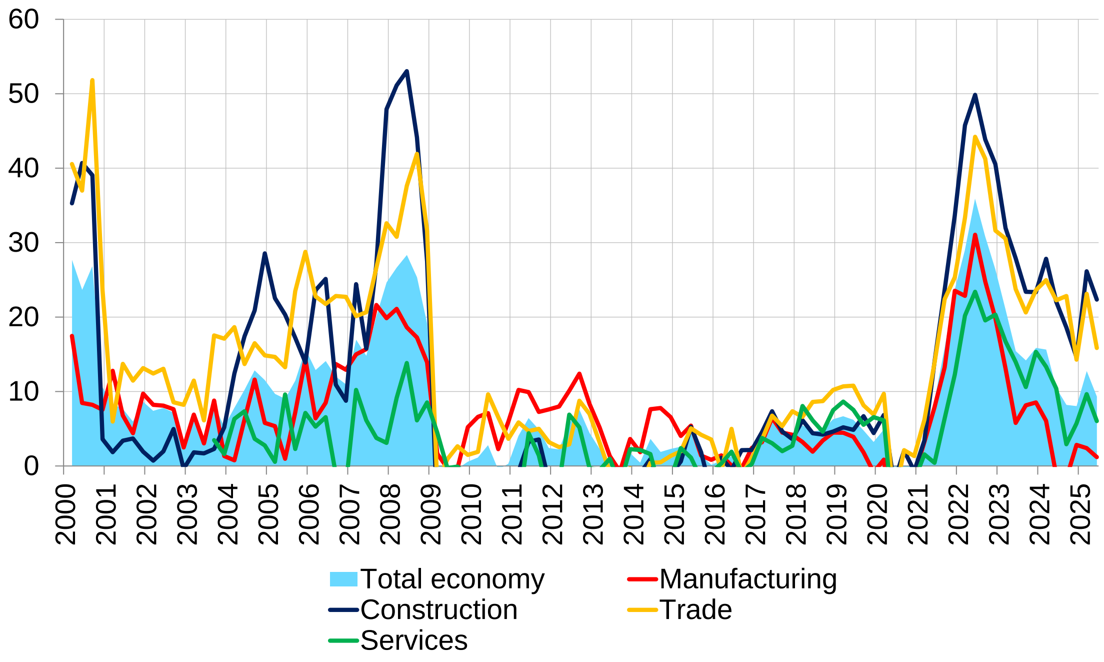
Stylized facts

- A complementary signal of regime transitions is the behaviour of inflation expectations
- They provide a signal of changes in inflation psychology

- Magnitude of prices increases also exhibits state dependence

Chart 3: Inflation expectations of firms

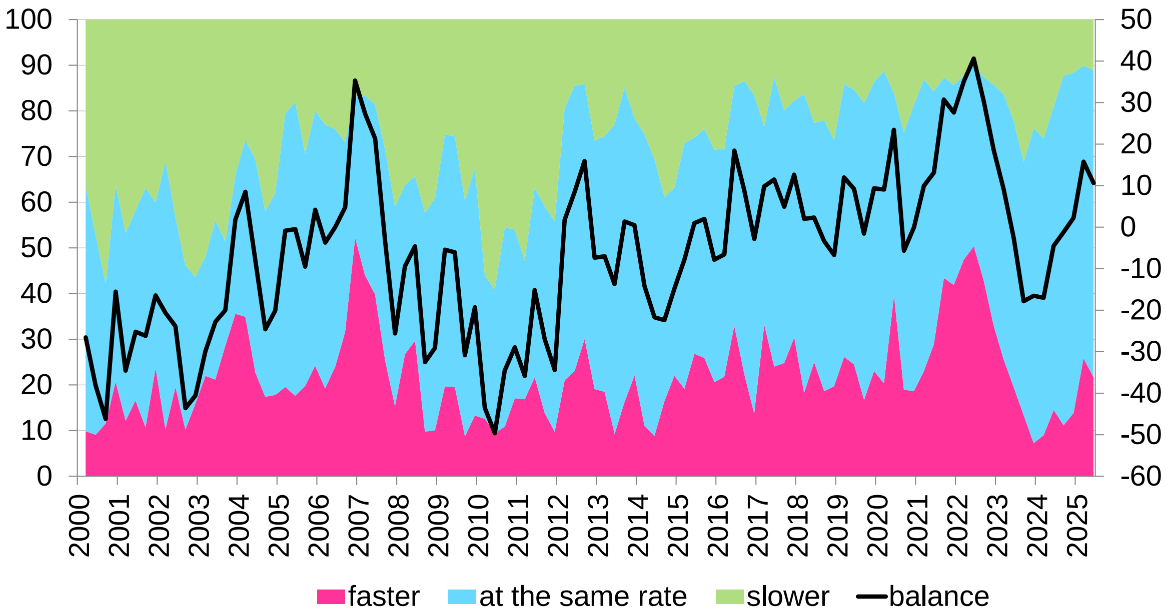
(balance of opinion, %)



Source: NSI, own calculations

Chart 4: Magnitude of price increases in retail trade

(share of firms) (balance of opinion)



Source: NSI, own calculations

Stylized facts

- Existing research highlights non-linear cost pass-through to consumer prices during high inflation with strong demand (i.e. steepening of the Phillips curve)
  - WDN 2 and WDN 3 projects
  - Econometric evidence (see Kasabov(2024))

$$\pi_t = \mu_t + \rho_t \pi_{t-1} + \theta_t \pi_t^e + \beta_{1t} \Delta ulc_t + \beta_{2t} \pi_t^{imp} + \beta_{3t} x_t + e^{\frac{h_t}{2}} \varepsilon_t$$

Chart 5: Estimates of β_{1t}

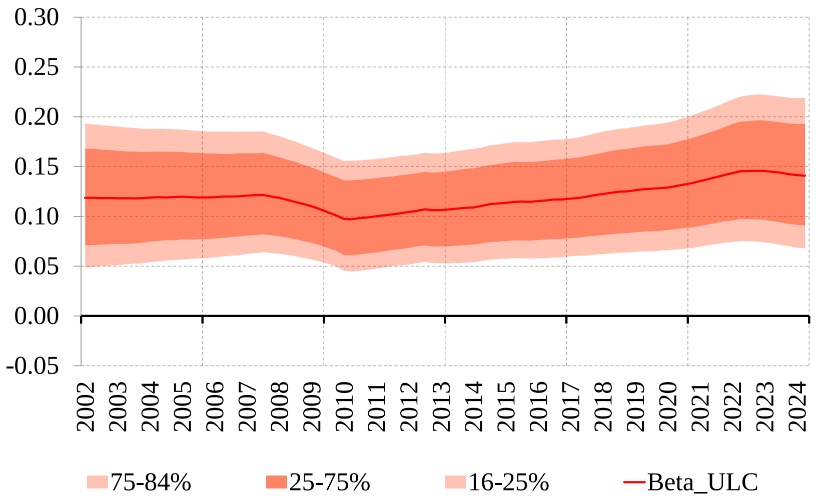


Chart 6: Estimates of ρ_t

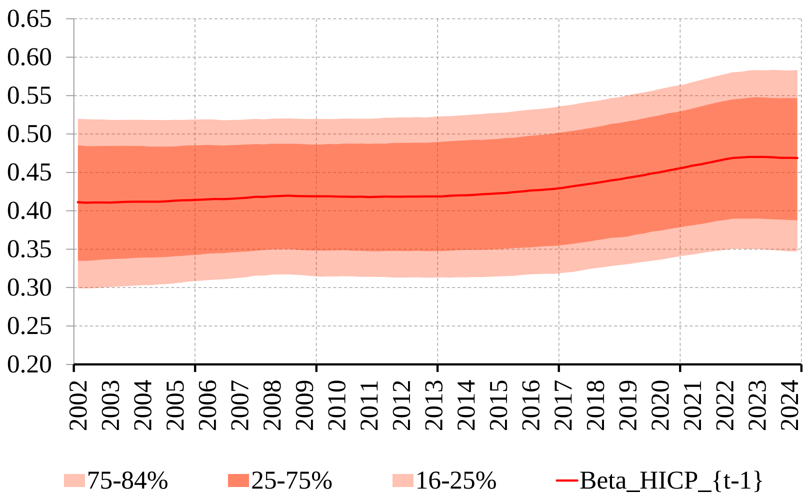
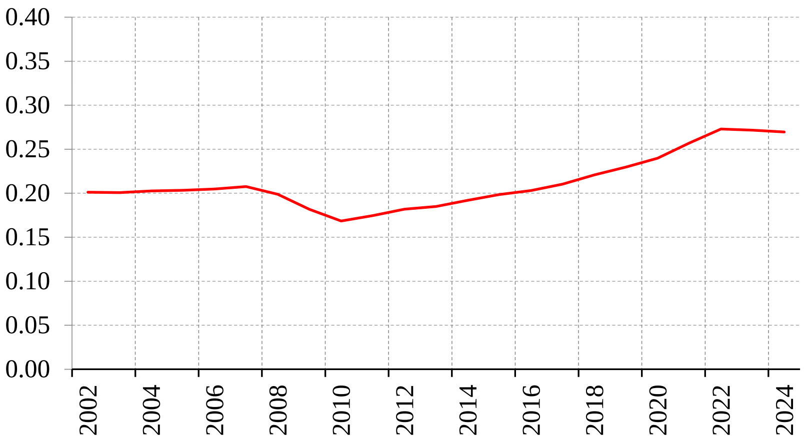


Chart 7: Labour cost pass-through (in the long-run)



Source: NSI, own calculations

Note: Labour cost pass-through from the Phillips curve model is estimated as $\beta_{1t} * (1 + \rho_t + \rho_t^2 + \cdots + \rho_t^{11})$

Outline

Methodology

For the empirical part of the research project, a model is required that accommodates the following:

- Multiple regimes: The model must allow the system to switch between different states of the economy
- Endogenous regime transitions: regime changes should be determined by an observable or latent variable that governs the switching process
- Regime-specific dynamics: each regime should have its own parameters, reflecting how relationships between variables can vary across different economic states
- Shock identification and pass-through: the model must be capable of identifying economic shocks (e.g., demand, supply) and analyzing their pass-through effects

Methodology – TVAR model

Threshold VAR model as proposed by Alessandri and Mumtaz (2017)

$$Y_t = \left[c_1 + \sum_{j=1}^{p} B_{1,j} Y_{t-j} + v_{1,t}\right] S_t + \left[c_2 + \sum_{j=1}^{p} B_{2,j} Y_{t-j} + v_{2,t}\right](1 - S_t) \quad (1)$$

$Y_t - matrix\ of\ endogenous\ variables$
$VAR(v_{1,t}) = \Omega_1$
$VAR(v_{2,t}) = \Omega_2$

$$S_t = 1 \quad \text{if} \quad \underbrace{Y_{j,t-d}}_{\substack{threshold\\ variable\\ (inflation)}} < \underbrace{Y^*}_{threshold} \quad (2)$$

(Note that if Y^* and d are known, then the TVAR is simply two VAR models defined over the appropriate data samples using $Y_{j,t-d} \leq Y^*$ and $Y_{j,t-d} > Y^*$)

- Both the delay d and the threshold Y^* parameters are estimated.
- As indicated in equation (1) both the transmission mechanism and the size of the shocks can change between the two regimes
- The estimation of the model utilizes a Gibbs algorithm (with a Metropolis Hastings step)

Methodology – TVAR model and data

- Baseline TVAR model -> 4 endogenous variables (N=4) *{Import prices, Exports, Output, HICP}*
- Number of lags (P) = 2
- Variables are transformed into log differences; data is at quarterly frequency (1999Q1 – 2024Q2)
- This choice of variables allows analyzing the pass-through from foreign and domestic shocks to the HICP
- Year-on-year HICP is the threshold variable used to distinguish regimes

- Estimation of the model follows Alessandri and Mumtaz (2017)
  - Bayesian estimation
  - natural conjugate prior is imposed on the TVAR parameters of equation (1) via dummy observations as proposed in Banbura et al. (2010)
  - The prior means are the OLS estimates of the coefficients of an AR(1) regression which is estimated for each endogenous variable (flat prior is chosen)
  - The model is estimated based on 25000 iterations of the Gibbs sampler with a 24500 iterations burn-in phase

Methodology – shock identification

- Orthogonalization produces statistically uncorrelated shocks by construction, providing clearer insights into the direct impacts of each shock
- Construct $\boldsymbol{u_t} = \boldsymbol{A}^{-1}\boldsymbol{v_t}$, where $\boldsymbol{u_t}$ are innovations (structural shocks) and $\boldsymbol{v_t}$ are model estimated residuals
- How to construct **matrix A** (~identify shocks)?
  - By imposing sign and zero restrictions based on economic theory

Identification of shocks

Variable \ Shock	Domestic demand	Domestic supply (technology)	Global demand	Global supply (foreign prices)
Real output	+	-	+	-
Inflation	+	+	+	+
Import prices	●	●	●	+
Exports	0	0	+	●

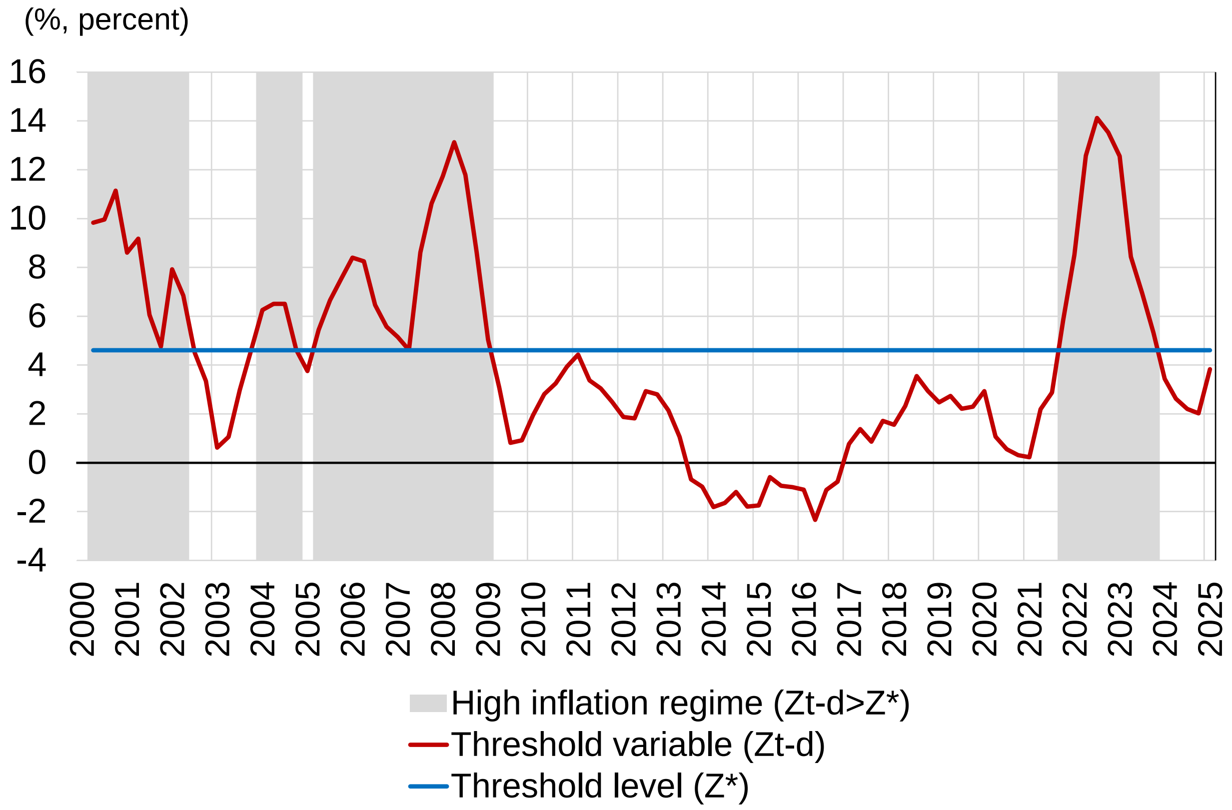
Notes: "•" = unconstrained, "+" = positive sign, "-" = negative sign, "0" = zero restriction. All restrictions are imposed on impact.

- ➢ Demand/Supply Shocks: Positive/negative correlations between real activity and prices
- ➢ Small Open Economy: Domestic variables do not affect global trends, distinguishing local from external shocks

Outline

Results – regimes

Chart 8: HICP year-on-year percentage change and estimated inflation regimes



Threshold level, Z* = 4.6%

“High inflation" regime covers the following periods:

- from Q1 2000 to mid-2002,
- from Q1 2004 to Q1 2009 (excluding Q1 2005),
- and from Q4 2021 to Q4 2023

Results – domestic demand shock

Chart 9: Impulse responses to a demand shock of **one standard deviation** in each regime (normalised to a one percent increase in real GDP on impact in each regime)

(%, log differences)

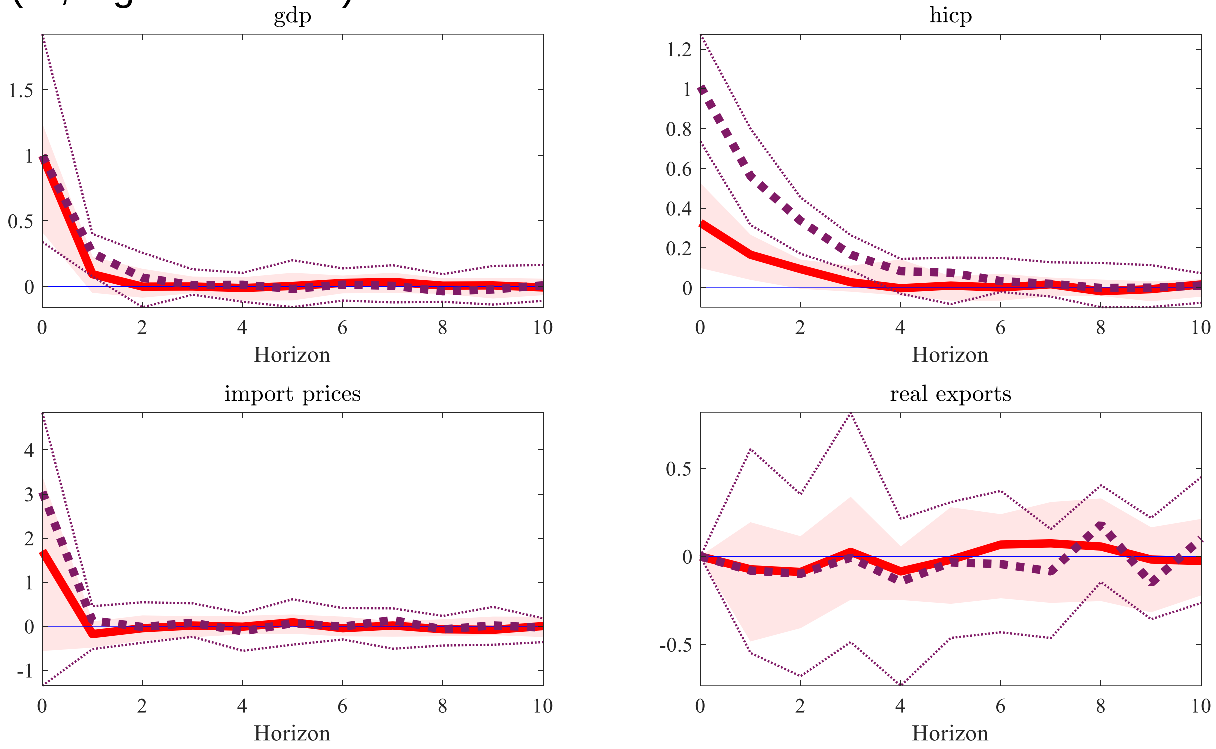
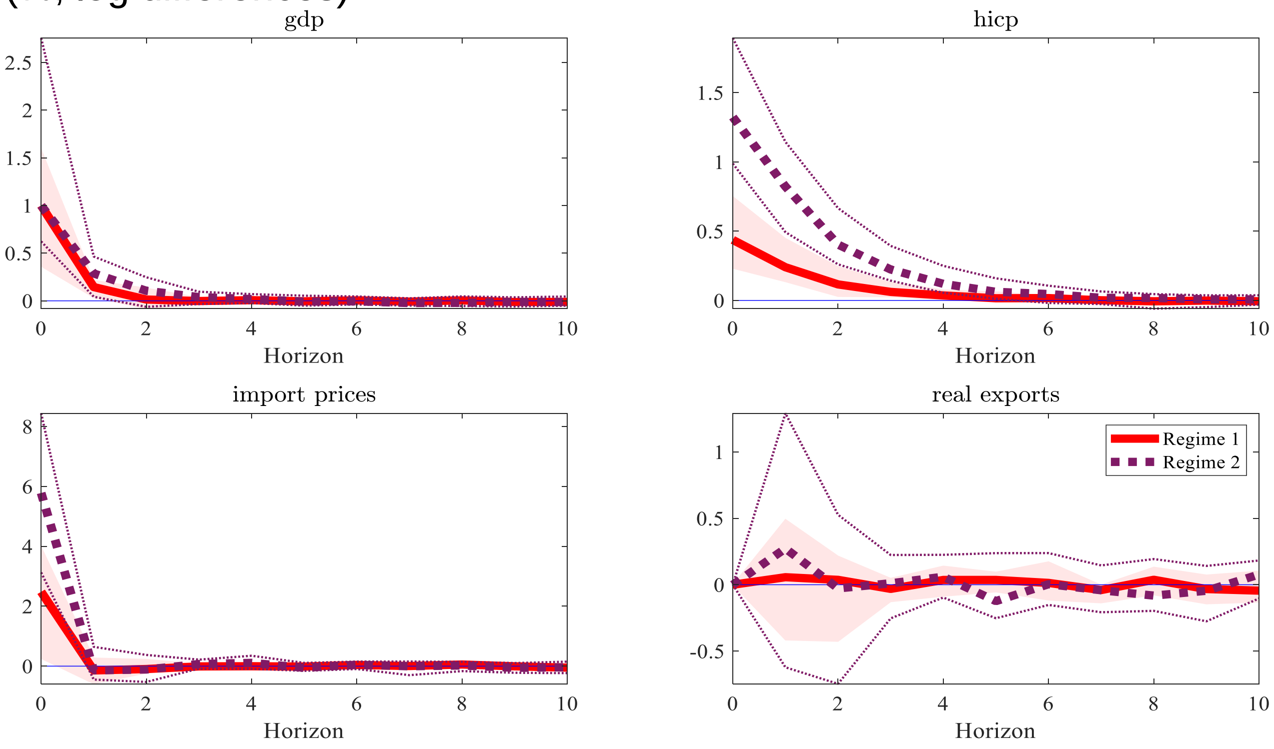


Chart 10: Impulse responses to a demand shock of **three standard deviations** in each regime (normalised to a one percent increase in real GDP on impact in each regime)

(%, log differences)



Regime 1 = LOW inflation regime
Regime 2 = HIGH inflation regime

Results – global supply (foreign price) shock

Chart 11: Impulse responses to a foreign price shock of **one standard deviation** in each regime (normalised to a one percent increase in import prices on impact in each regime)

(%, log differences)

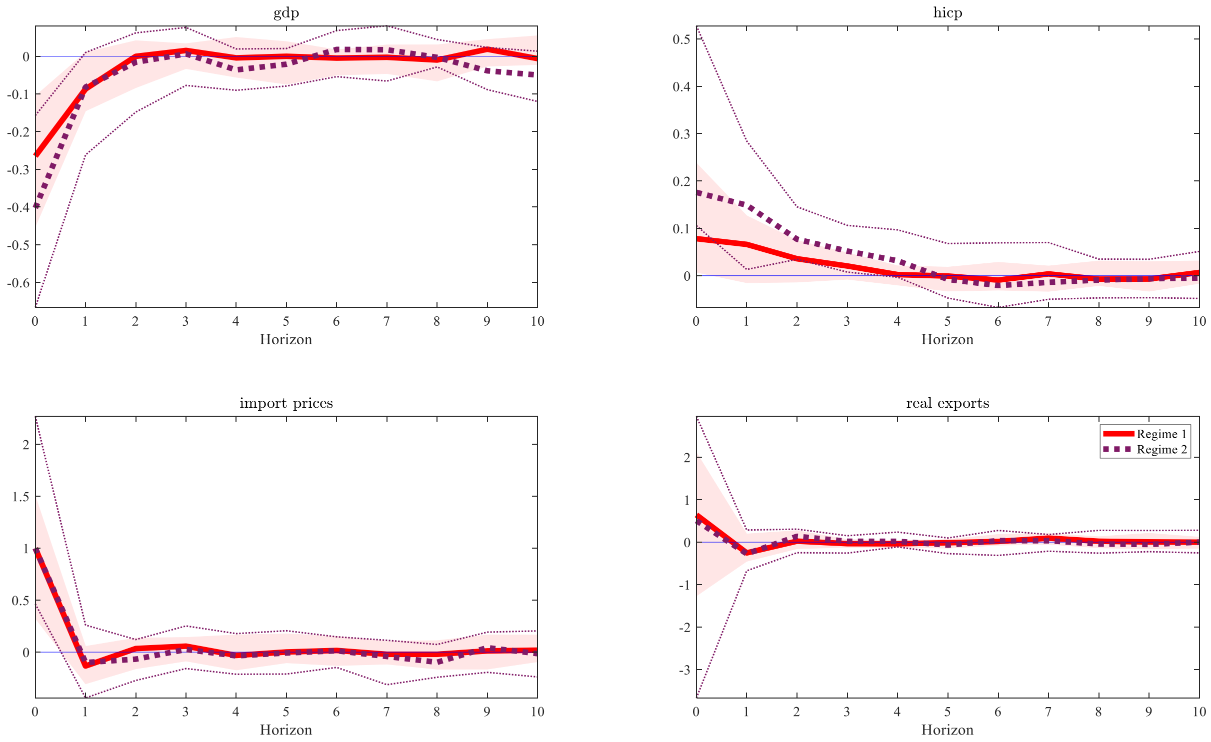
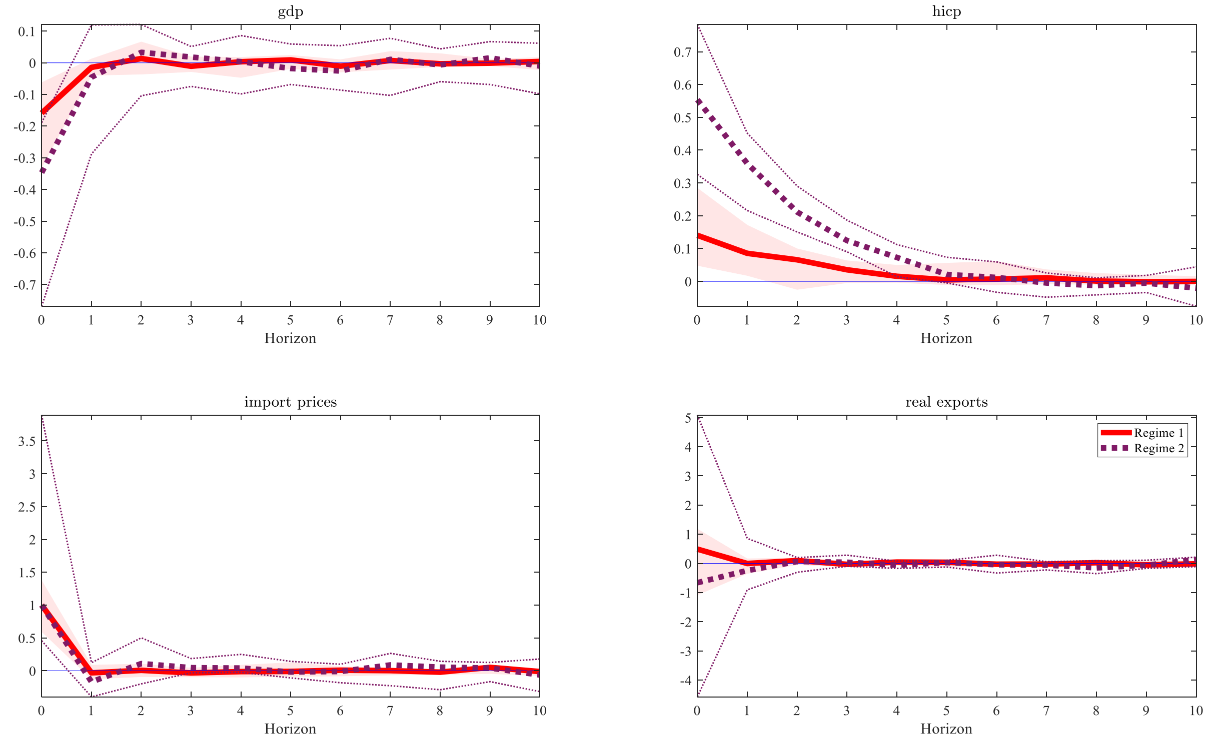


Chart 12: Impulse responses to a foreign price shock of **two standard deviations** in each regime (normalised to a one percent increase in import prices on impact in each regime)

(%, log differences)



Regime 1 = LOW inflation regime
Regime 2 = HIGH inflation regime

Outline

Conclusion

- Inflation in Bulgaria is regime-dependent, with high- and low-inflation periods exhibiting distinct dynamics in terms of volatility, persistence, and sectoral spillovers.
- Shock transmission is nonlinear, with domestic demand and global supply shocks exerting disproportionately larger effects during high-inflation regimes, particularly when shocks are of high magnitude
- Pre-emptive, carefully calibrated fiscal and monetary measures are essential when the risk of high inflation arises
- When discretionary fiscal interventions are necessary to address the social consequences of adverse supply shocks and cost-of-living crises, these measures should be carefully targeted and designed to remain neutral with respect to aggregate demand