Box 7. Changes over time in the monetary policy transmission mechanism. Evidence based on vector autoregressive models

Over the past two decades, the evolution of the Romanian economy has been marked by several distinct periods, characterised by major economic, political or institutional events, such as the EU accession or the international financial crisis. Thus, the monetary policy transmission mechanism – which encompasses all the channels whereby the central bank influences macroeconomic variables by using a varied set of monetary policy instruments – is likely to have witnessed changes over time. Analysing the way in which the monetary transmission mechanism has changed is important both in order to assess the past policy stance and to improve the ongoing process of real-time monetary policy decision-making.

A time-varying parameter vector autoregressive (VAR) model was implemented to estimate the historical changes in monetary policy transmission mechanism. VAR models represent a frequently used analytical method for the estimation of the effects of monetary policy shocks on macroeconomic variables; see, for instance, Christiano *et al*. (1999) and Kim and Roubini (2000). In spite of their flexibility and advantage of solving the reverse causality issues among the modelled variables, the linear specifications and the constant nature of parameters and of shock volatilities (determined by the corresponding standard deviations) constitute major limitations of the VAR models used in these papers. More recent analytical developments, in particular Cogley and Sargent (2005) and Primiceri (2005), have helped relax some of these restrictions by considering time-varying vector autoregressive models with stochastic volatility (i.e. the standard deviations of residual components vary in time, the same as the other coefficients). Hence, these specifications involve the existence of two variation sources at the level of economic mechanisms implicit to the models, namely the changes over time in the links between endogenous variables and those of the size of structural shocks.

A standard set of macroeconomic indicators for small open emerging economies, similar to that used by Franta *et al*. (2014) in the case of Czechia, was considered in order to assess the changes over time in the monetary policy transmission mechanism in Romania: the quarterly rate of adjusted CORE2 inflation (seasonally adjusted), calculated by excluding the direct effects of the changes in the VAT rate; the quarterly dynamics of real GDP (seasonally adjusted); the monetary policy rate; the quarterly dynamics of the EUR/RON exchange rate. The sample runs from 2000 Q2 to 2018 Q4[1].

Charts A presents the estimated stochastic volatility of the four structural shocks (median values and 80 percent confidence intervals). Several common trends across all innovations stand out. The period of maximum macroeconomic volatility was recorded in the context of the global economic and financial crisis, marked by heightened uncertainties and adverse developments at the level of all analysed

[1] Similarly to Primiceri (2005) and Franta *et al*. (2014), two lags were considered, alongside a recursive identification scheme (Cholesky decomposition) and time variations in line with nonstationary processes for coefficients and standard deviations of shocks. The estimation was performed using numerical algorithms specific to Bayesian methods. For technical details, see Cogley and Sargent (2005) and Primiceri (2005).

variables. In the recent period (2015–2018), the volatility of shocks has been relatively low, given the quasi-stable evolutions of nominal variables, inter alia amid keeping the monetary policy rate at 1.75 percent May 2015 through December 2017 and the subdued fluctuations in the exchange rate dynamics (monthly changes ranging between –1.2 percent in February 2015 and +1.3 percent in December 2016). The generally downward trends displayed by the volatility of shocks on nominal variables across the analysed sample are also partly explained by the downward adjustment of the NBR's inflation target until 2012, which supported the consolidation of disinflation.

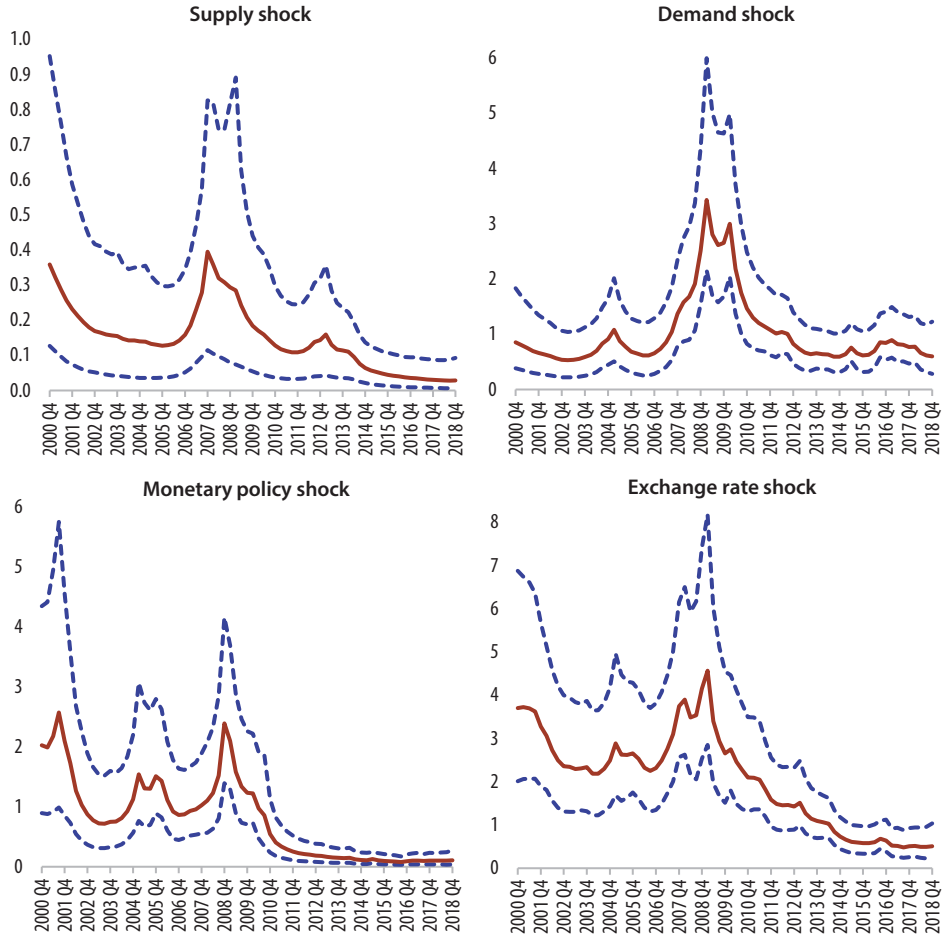

Chart A
Stochastic volatility of structural shocks (median values and 80 percent confidence intervals)

The conventional approach in the literature with regard to the monetary policy transmission mechanism implies several stages, determining a certain time lag between the adoption of the central bank's decision and the effect felt in the economy. Policy rate changes feed through to the money market and then into bank lending and deposit rates as well. The level of the latter is key for economic agents' decisions regarding consumption, investment and savings (including the distribution of instruments denominated in domestic or foreign currency). Thus, the impulse sent by the central bank indirectly affects the aggregate demand

components and, hence, the deviation of real GDP from its potential level, which in turn is a determining factor for consumer price inflation[2].

In order to assess the changes over time in the monetary policy transmission mechanism, Chart B depicts the effects of a monetary policy shock on the four modelled variables. These effects are calculated as averages for three distinct periods: pre-crisis (2005-2008), the economic crisis and the related recovery stage (2009-2012), post-crisis (2013-2018)[3]. With a view to ensuring the comparability of responses, the magnitude of the shock has been normalised so as to imply a tightening of monetary policy equal to a 1 percentage point rise in the policy rate[4].

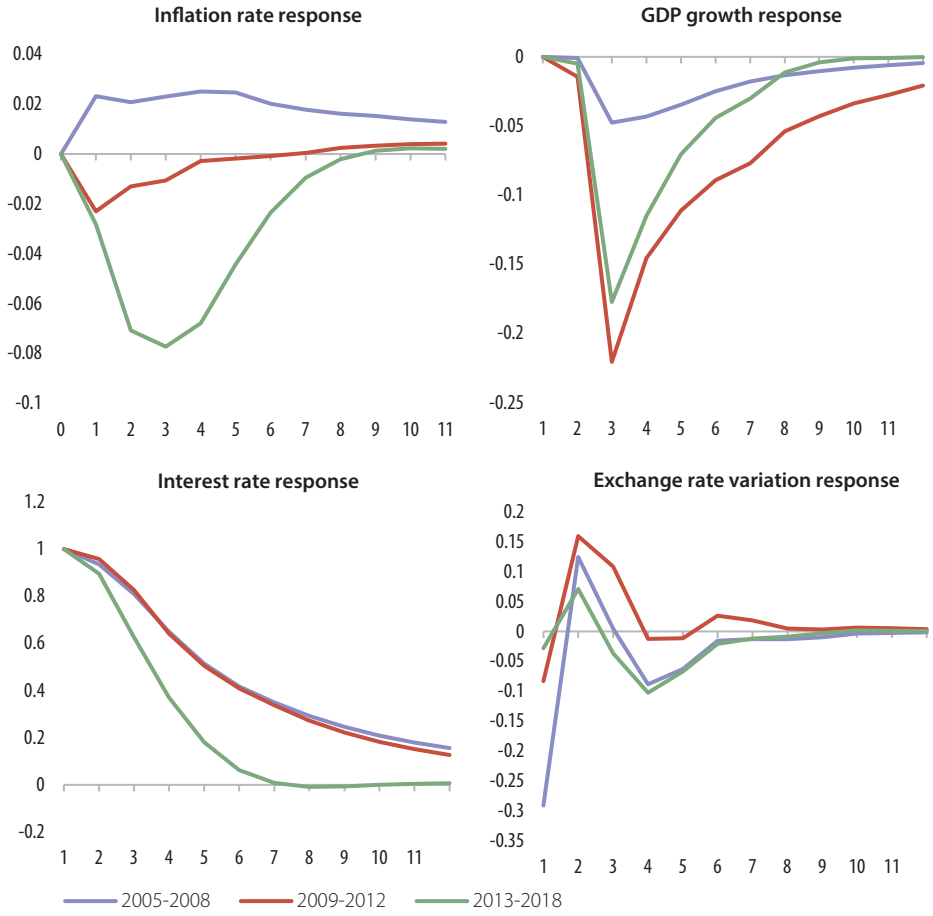

Chart B
Response functions of endogenous variables to a monetary policy shock of a 1 percentage point rise in the policy rate (period averages)

Note: Percentage points on the OX axes, quarters since the occurrence of the shock on the OY axes.

The analysis by timespans shows a similar impact of monetary policy shocks on the policy rate trajectory during the periods 2005–2008 and 2009–2012. The post-crisis stage implies, however, a faster dissipation of the monetary policy instrument

2 For further details on the monetary policy transmission channels and the NBR's forecasting framework, see the "Monetary Policy" section on the NBR website.

3 In principle, the time-varying parameter VAR model results in individual impulse response functions for each quarter. For a synthesis of results, in Chart B they are aggregated in three distinct periods and expressed as averages. Given the formal adoption of the inflation targeting strategy in August 2005, Chart B does not refer to the period from 2000 to 2004.

4 Given the linearity of impulse response functions constructed for each moment in time, the effects of a monetary policy shock implying a 1 percentage point cut in the policy rate have the same magnitude, but opposite signs relative to those depicted in Chart B.

response. The economic growth response is much stronger in the recent period than in the pre-crisis stage: in the 2005-2008 period, the quarterly GDP dynamics decrease by up to 0.05 percentage points in the second quarter after the shock, whereas in the 2013-2018 period the decline is of 0.18 percentage points. The effect exerted by monetary policy shocks on the quarterly rate of adjusted CORE2 inflation has witnessed significant changes. While in the pre-crisis period core inflation went up following the monetary policy rate hike[5], the period from 2009 to 2012 certifies a response in line with economic theory, albeit of a low magnitude (decline of no more than 0.02 percentage points in the quarter following the shock, the equivalent of below 0.1 percentage points in annualised terms). The recent periods have seen a steeper decline in the quarterly inflation rate as a result of monetary policy tightening, with the peak response being recorded three quarters after the shock (a reduction of 0.08 percentage points, the equivalent of over 0.3 percentage points in annualised terms). The persistent trajectory with a lagged peak response is consistent with the gradual pass-through of monetary policy impulses and with the eight-quarter projection horizon specific to the NBR's quarterly forecasting rounds. The exchange rate response has a similar pattern within the three periods under review, with an appreciation contemporaneous with the policy rate increase, but is softer in the case of recent periods, given the minor fluctuations in the EUR/RON.

The results presented above certify the gradual improvement in the monetary policy transmission mechanism. The structural developments compatible with this conclusion include: (i) the larger share of leu-denominated private sector credit (up to 66 percent of total in December 2018 versus a low of 35.6 percent in May 2012), (ii) the narrower share of exogenous components[6] in the consumer basket (from 42.1 percent in 2005 to 39 percent in 2018; additionally, the share of processed food items in the adjusted CORE2 index shrank from 56.3 percent in 2005 to 42.3 percent in 2018), (iii) the shift to the multiannual flat inflation target of 2.5 percent ±1 percentage point in 2013, as well as (iv) the higher degree of monetary policy transparency and predictability – inter alia by developing/diversifying in time the ways of communication with the public – conducive to consolidating the central bank's credibility and to a more effective anchoring of inflation expectations.

The outlook for the monetary policy transmission mechanism is surrounded by uncertainties associated with the effects of implementing the provisions of GEO No. 19/2019. In particular, replacing in household loan contracts the ROBOR rate with a benchmark index calculated based on interbank transactions is likely to alter the link between the monetary policy rate and financial institutions' interest rates applicable to their customers.

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5 Christiano *et al.* (1999) claim that the counterintuitive increase in prices following a rise in the policy rate (the so-called 'price puzzle') denoted by some empirical works may be due to confounding monetary policy shocks with supply shocks signalling future price increases. To solve this, the authors propose to include in the models a measure sensitive to current and expected economic developments, such as oil prices or of other commodities. Another interpretation of the counterintuitive response of prices refers to the cost channel, relevant for heavily indebted companies, in the sense that an interest rate hike entails higher production costs and, subsequently, more expensive final goods.

6 They refer to prices on which monetary policy (via aggregate demand management) has limited or no influence, i.e. administered prices, volatile prices (vegetables, fruit, eggs, fuels), tobacco product and alcoholic beverage prices.

References

Christiano, L. J., Eichenbaum, M. and Evans, C. L. – "Monetary Policy Shocks: What Have We Learned and to What End?", *Handbook of Macroeconomics*, edited by J. B. Taylor and M. Woodford, Vol. 1, Part A, chapter 2, Elsevier, 1999, pp. 65-148

Cogley, T. and Sargent T. J. – "Drifts and Volatilities: Monetary Policies and Outcomes in the Post WWII US", *Review of Economic Dynamics*, Vol. 8, 2005, pp. 262-302

Franta, M., Horvath, R., and Rusnak, M. – "Evaluating Changes in the Monetary Transmission Mechanism in the Czech Republic", *Empirical Economics*, Vol. 46(3), 2014, pp. 827-842

Kim, S. and Roubini, N. I. – "Exchange Rate Anomalies in the Industrial Countries: A Solution with a Structural VAR Approach", *Journal of Monetary Economics*, Vol. 45(3), 2000, pp. 561-586

Primiceri, G. – "Time Varying Structural Vector Autoregressions and Monetary Policy", *Review of Economic Studies*, Vol. 72, 2005, pp. 821-852.