Monetary Policy in an Oil-Dependent Economy in the Presence of Multiple Shocks

Andrej Drygalla

Halle Institute for Economic Research (IWH)

November 27, 2017

Gliederung

In a nutshell

- How can monetary policy in Russia reduce the impacts of shocks to the oil price and capital flows?
- Estimation of a DSGE model for Russia (2000 to mid-2015)
- Extension of a standard small open economy model by Justiniano and Preston (JAE, 2010)
  - Oil exporting sector
  - Micro-founded FX market (Bacchetta and van Wincoop (AER, 2006), Montoro and Ortiz (2013), Malovana (2015))
- Transmission channels of central bank interventions (direct and expectations)
- Novelty: estimation of a model with endogenous FX market interventions

Stylized facts

- Devaluation pressure on the Russian currency due to
  - Large capital outflows
  - Collapse of the oil price
  - Problems of refinancing external debt due to financial sanctions
- Exchange rate management by the central bank to „limit excessive value fluctuations“of the dual-currency basket
  - Policy rate increases
  - Sales of FX reserves
- Exchange rate policy officially abandoned on November 7, 2014
- Currency devaluation at most delayed but hardly prevented, but potential negative impact on economic activity (through increased borrowing costs)

Empirical evidence

- Malakhovskaya/Minabutdinov (2013):
  - Estimated DSGE model of the Russian economy (1999 to 2011)
  - Comparable setting 2008/09: large capital outflows, slump in oil prices
  - Restrictive monetary policy aimed at exchange rate stabilization
  - Prevented (stronger) rouble depreciation
  - Fueled economic downturn (and reduced oil revenue value in roubles)
- Russian monetary policy described by the presence of two targets
  - Price stability
  - Exchange rate stability
- and is conducted via two instruments
  - Monetary policy rate
  - FX market interventions

Outline

FX market

- Continuum of dealers d in the domestic economy in the interval $d \in [0, 1]$
- Each dealer receives
  - ω_t^d and $\omega_{cb,t}^d$ in domestic bond sale and purchase orders from households and the central banks
  - $\omega_t^{d,*}$ and $\omega_{cb,t}^{d,*}$ in foreign bond sale orders from foreign investors and the central bank
- Ex-post holdings of domestic and foreign bonds by dealer d are

$$B_t^d + e_t B^{d,*} = \omega_t^d - \omega_{cb,t}^d + e_t(\omega_t^{d,*} + \omega_{cb,t}^{d,*})$$

- Dealers select optimal portfolio allocation in order to maximize the expected utility of their end-of-period returns

FX market

- Dealers select optimal portfolio allocation in order to maximize the expected utility of their end-of-period returns $-E_t^d e^{-\gamma \Omega_{t+1}^d}$

$$\Omega_{t+1}^d = (1 + i_t) B_t^d + (1 + i_t^*) e_{t+1} B_t^{d,*}$$

- Each dealer's demand for foreign bonds dependent on interest rate difference, expected exchange rate dynamics, risk aversion and exchange rate volatility
- Aggregation of all dealers and equilibrium condition on the FX market leads to a risk-adjusted uncovered interest parity condition (in logs):

$$E_t e_{t+1} - e_t = r_t - r_t^* + \gamma \sigma_{\Delta e}^2 (\omega_t^* + \omega_{cb,t}^*)$$

nominal exchange rate e_t, interest rate difference $r_t - r_t^*$, risk aversion γ, exchange rate volatility $\sigma_{\Delta e}^2$ and supply of foreign bonds from investors ω_t^* and the central bank $\omega_{cb,t}^*$

FX market

- Supply of foreign bonds by foreign investors (capital inflows)

$$\omega_t^* = \rho_{\omega^*} \omega_{t-1}^* + \eta_t^{\omega^*}$$

- Supply of foreign bonds by central bank (intervention)

$$\omega_{cb,t}^* = \phi_{\Delta e, int} \Delta e_t + \eta_t^{\omega^{int}}$$

with i.i.d. shocks $\eta_t^{\omega^*} \sim N(0, \sigma^2_{\eta^{\omega^*}})$ and $\eta_t^{\omega^{int}} \sim N(0, \sigma^2_{\eta^{\omega^{int}}})$

FX market

$$E_t e_{t+1} - e_t = r_t - r_t^* + \gamma \sigma_{\Delta e}^2 (\omega_t^* + \omega_{cb,t}^*)$$

- Interventions have an impact on the exchange rate via two channels
- Portfolio balance channel $\gamma \sigma_{\Delta e}^2 (\omega_t^* + \omega_{cb,t}^*)$
  - Sale (purchase) of foreign bonds by the CB increases (reduces) the ratio between foreign and domestic assets held by dealers
  - Appreciation (depreciation) of the domestic currency, because dealers require a greater (smaller) risk premium to hold a larger (smaller) quantity of the foreign currency
- Signaling channel $E_t e_{t+1}$
  - CB interventions signal future changes in policy that affect expectations
  - Change in $E_t e_{t+1}$ caused by FX interventions will have an effect on the spot exchange rate

Oil sector

- Oil sector revenues (in domestic currency) distributed to private households

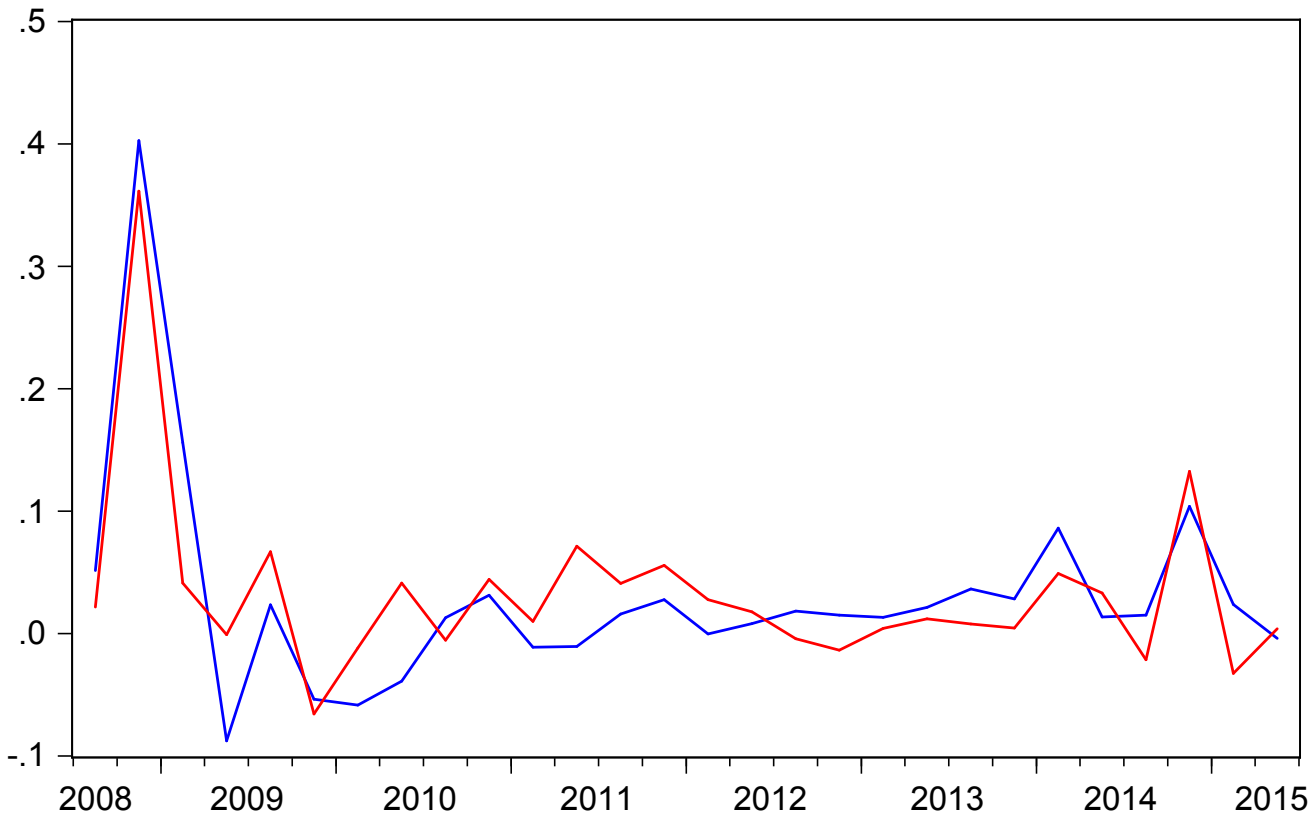
$$Y_t^O = P_t^O e_t$$

- All demand is satisfied, variations in the revenues result from fluctuations in the dollar price of oil and the exchange rate
- Oil price follows an exogenous AR(1) process (in logs)

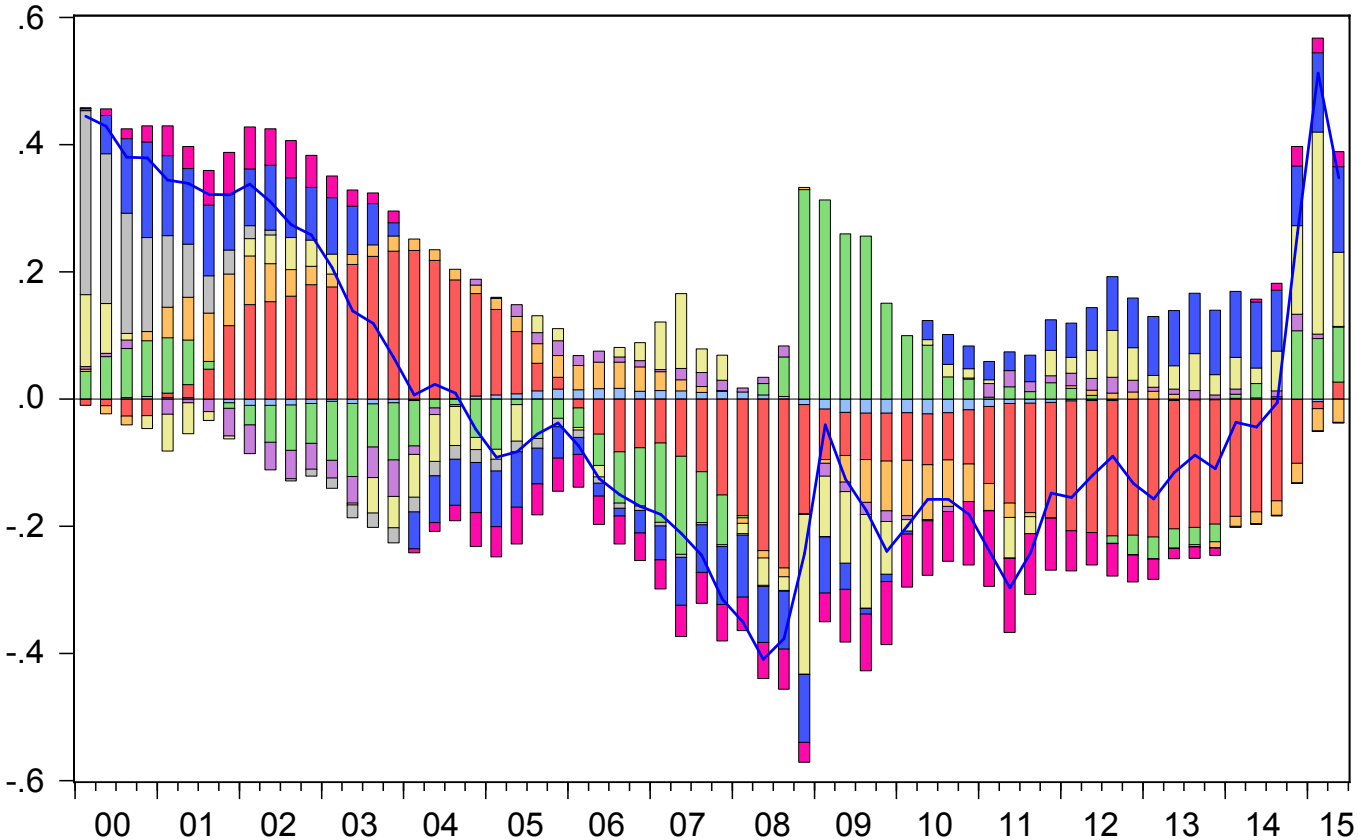
$$p_t^O = \rho_O p_{t-1}^O + \eta_t^O$$

Outline

Actual and smoothed interventions



Historical decomposition real exchange rate



Policy evaluation

- Simulation of the model with parameters calibrated to their estimated posterior means
- Shock to oil prices, capital flows and both disturbances occurring simultaneously
- Dual shock scenario calibrated to match correlation of smoothed shock series
- Estimated policy in place (baseline) compared to five alternative policy strategies:
  - Inflation targeting (reaction parameter 1.5)
  - Strict inflation targeting (reaction parameter ∞)
  - Fix exchange rate (reaction parameter in intervention rule ∞)
  - Ruble price of oil targeting (reaction parameter in intervention rule ∞)
  - Hybrid inflation targeting (reaction parameters 1.5 and 0.5)

Alternative policy strategies

- Inflation targeting via policy rate
  - No active exchange rate management → monetary policy adjusted such that effects on import prices are balanced by opposite dynamics of domestic prices
  - Smaller impact of dual shocks on GDP aggregates, wages and inflation; higher volatility of domestic inflation
  - Differences to current policy larger the stronger the policy reaction to price dynamics
- Fix exchange rate via interventions
  - No independent monetary policy → interest rate not used as a policy instrument
  - Identical dynamics of oil prices in domestic currency → stronger impact on domestic wages and prices
  - Monetary policy not capable to prevent them from rising → significantly higher volatility of total inflation

Alternative policy strategies

- Ruble price of oil targeting via interventions
  - *Peg the export price index* (Frankel (JPM, 2005))
  - Credible anchor for monetary policy, accommodation of terms of trade shocks, reliable real time data
  - No independent monetary policy $\rightarrow$ interest rate not used as a policy instrument
  - Central bank reinforces initial exchange rate dynamics $\rightarrow$ higher volatility of import prices, total inflation and trade aggregates
  - Inadequate strategy to absorb oil price shocks

Conclusion and outlook

- Russian economy best shed from shocks to oil prices and capital flows by adopting any form of inflation targeting
- Discrete interventions to counter discrete destabilizing capital flows
- However, simplifying model assumptions
  - Oil prices and capital flows follow AR(1) processes $\rightarrow$ no persistent effects
  - Capital flows have no effects on variables besides the exchange rate and are completely exogenous, i.e. random
  - Influenced by political arbitrariness and non-existent rule of law $\rightarrow$ endogenize
  - Provide/pull out funds for productive capital formation $\rightarrow$ include in investment function

Thank you very much for your attention.