A CASE FOR LEANING AGAINST THE WIND IN A COMMODITY-EXPORTING ECONOMY

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The views expressed in this presentation are solely those of the authors and do not necessarily reflect the official position of the Bank of Russia.
Commodity price changes are important source of relative price (real exchange rate) changes and macroeconomic volatility in commodity-exporting economies (CEEs)

• see Medina and Soto (2007) for Chile, Bergholt et al. (2017) - Norway, Kreptsev and Seleznev (2017) - Russia

**Figure 1.** Median real effective exchange rate indices for commodity and non-commodity exporters
1. Inflation targeting (IT) central banks may face a trade-off when a commodity price shock hits. Bergholt (2014, 2017), Charnavoki (2010), Allegret et al. (2015), Hamann et al. (2016) for commodity exporters:

    Exchange rate changes and exchange rate pass-through to inflation vs.
    Effect of the shock on economic activity

Kormilitsina (2011), Bodenstein et al. (2012), Plante (2014) for net commodity importers:

    Pass-through of imported commodities prices to inflation vs.
    Effect of the shock on economic activity

The first issue: How do IT central banks react to commodity shocks in practice? or Following Bernanke, et al. (1997): How does monetary policy systematically react to commodity shocks?
2. Commodity price changes may be a source of credit booms and busts in CEEs


The second issue: What is contribution of (systematic) monetary policy reaction under IT to commodity prices in \textit{observed} dynamics of real credit after a commodity shock?
3. Relative price changes (under commodity shocks) may misguide the central banks regarding inflation and financial stability trade-off - Borio et al. (2014, 2016, 2018), BIS annual economic report (2018)

Leaning against the wind (LAW), Svensson (2013), is a way to solve the trade-off, when a central bank lacks effective macroprudential policy. See discussion in Andrian and Liang (2016), Svensson (2017a), Svensson (2017b), Agenor and Pereira da Silva (2019). Ajello et al. (2019)

The third issue: from the normative point of view, can monetary policy under IT in a CEE better stabilize inflation and output if it takes into account its own effects on volatility of real credit (that feeds back into inflation and output volatility)?

or Can LAW alone lead to better macroeconomic outcome?
The first issue: How do IT central banks react to commodity shocks *in practice*? or Following Bernanke, et al. (1999): How does monetary policy *systematically* react to commodity shocks?
- Review DSGE models of IT-CEEs central banks, estimated over period of IT
- Estimate *panel SVARs* and *Local projection models* (LPM) for IT countries

The second issue: What is contribution of (systematic) monetary policy reaction under IT to commodity prices in observed dynamics of real credit after a commodity shock?
- Apply the Sims and Zha (1995, 2006) approach and (as a robustness check) that by Bernanke et al. (1997)

The third issue: Can LAW alone lead to better macroeconomic outcome?
- compare inflation targeting and LAW in an estimated DSGE model for Russia from Kreptsev and Seleznev (2017). It is a small open economy model with a commodity-exporting sector (oil). It incorporates a friction similar to Bernanke, et al. (1999) with a banking sector as in Gerali et al. (2010) and a country risk-premium elastic to oil-price changes as in Gonzales et al. (2016).
• We estimate panel SVARs and Local projection models (LPM) for IT countries grouped as in Table 1. to check impulse responses of policy rates and real credit to a positive commodity price shock. Datasamples: IT period.

• Vector autoregression model (VAR) is:

\[ Y_t = \alpha + \Phi_1 Y_{t-1} + \cdots + \Phi_p Y_{t-p} + \varepsilon_t \]

\[ Y_t = (\text{GlobalGDP}_t, \text{ComdtyPriceIndex}_t, \text{GDP}_t, \text{Inflation}_t, \text{Policy rate}_t, \text{Credit}_t) \]

• Local projection model (LPM) as in Jorda (2005)

<table>
<thead>
<tr>
<th>Commodity exporters</th>
<th>Non-commodity exporters (importers)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emerging market economies</strong></td>
<td>Brazil, Chile, Colombia, Indonesia, Mexico, Peru, Philippines, South Africa</td>
</tr>
<tr>
<td><strong>Developed market economies</strong></td>
<td>Australia, Canada, New Zealand, Norway</td>
</tr>
</tbody>
</table>
• IT CE EMEs tend to reduce policy rates after a positive commodity shock (Chart on the left), while commodity importers and CE AEs raise policy rates. Possible explanations of the differences in IRFs for CE EMEs vs CE AEs: anchored inflation expectations, prudent fiscal policy in AEs, cyclicality of capital flows, elasticity of domestic output gap to commodity prices (PC correlation).

Figures 2-3. IRF in VAR model for credit and policy rate for CE EME (Exporters) and NCE DE (Importers)
The first issue: findings

- Possible explanations of the differences in IRFs for CE EMEs vs CE AEs:
  - anchored inflation expectations,
  - prudent fiscal policy in AEs (fiscal rule),
  - cyclicality of capital flow, size of ERPT
  - elasticity of domestic output gap to commodity prices (PC correlation).

**Table 2.** Results of testing for significance of impulse responses in panel LPMs and VARs to a positive commodity price shock (= growth of a commodity price)

<table>
<thead>
<tr>
<th></th>
<th>Commodity exporters</th>
<th>Non-commodity exporters (importers)</th>
</tr>
</thead>
</table>
| Emerging market economies     | **VAR**  
Interest rate: Decrease Q1 – Q4  
Credit: Increase Q1 – Q8      | Interest rate: Increase Q5 – Q8  
Credit: Increase Q1 – Q8 |
|                                | **LPM**  
Interest rate: Decrease Q1 – Q3  
Credit: Increase Q1       | Interest rate: Increase Q5 – Q8  
Credit: Insignificant (Increase) |
| Developed market economies    | **VAR**  
Interest rate: Increase Q1 – Q8  
Credit: Decrease Q1      | Interest rate: Increase Q1 – Q8  
Credit: Decrease Q1 – Q4 |
|                                | **LPM**  
Interest rate: Increase Q3 – Q8  
Credit: Insignificant (Decrease) | Interest rate: Increase Q1 – Q8  
Credit: Decrease Q1 – Q3 |

Source: authors’ calculations.

**Table 2.** Statistically significant IRFs in VAR/LPM model for credit and policy rate
The second issue: findings

- Calculations using the Sims and Zha (1995) approach show that the endogenous nominal rates reduction under inflation targeting in commodity-exporting EMEs accounts for 20% of real credit increase on average after a positive oil price shock.

**Table 4.** Results of counterfactual procedure by Sims and Zha (2006) for a sub-sample of inflation-targeting countries

<table>
<thead>
<tr>
<th>Inflation-targeting country</th>
<th>Counterfactual level of credit relative to actual, %</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Commodity exporters</td>
</tr>
<tr>
<td>Brazil</td>
<td>- 3.1</td>
</tr>
<tr>
<td>Chile</td>
<td>- 17.5</td>
</tr>
<tr>
<td>Colombia</td>
<td>- 2.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>- 58.6</td>
</tr>
<tr>
<td>Peru</td>
<td>- 2.2</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>-20.2</strong></td>
</tr>
<tr>
<td></td>
<td>Other inflation-targeting (non-commodity-exporting) countries</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>+ 0.4</td>
</tr>
<tr>
<td>Israel</td>
<td>- 18.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>+ 4.1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>+ 7.3</td>
</tr>
<tr>
<td>Guatemala</td>
<td>- 21.6</td>
</tr>
<tr>
<td>Poland</td>
<td>+ 14.2</td>
</tr>
<tr>
<td>Serbia</td>
<td>- 12.8</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>-3.9</strong></td>
</tr>
</tbody>
</table>

*Note: Russia is absent in the sample due to a short time series (inflation targeting started only in 2015).*
Figure 4. The block scheme of the model with the banking sector (from Kreptsev, Seleznev (2017))
Changes in the basic DSGE model:

1. Loss function has the following form (as in Verona et.al., 2017):

   \[ L = \text{var}(\pi) + \text{var}(Y) + \alpha_{cr} \text{var}(Cr) \]

   Where: \( \text{var}(\pi) \) – variance of inflation, \( \text{var}(Y) \) – variance of GDP, \( \text{var}(Cr) \) – variance of credit to GDP ratio, \( \alpha_{cr} \) – weight of credit variance on the loss function.

2. We add a credit variable to the policy rule.

   \[
   \frac{R_t}{R^*} = \left( \frac{R_{t-1}}{R^*} \right)^{\phi_R} \left( \frac{\pi_t}{\pi^*} \right)^{(1-\phi_R)\phi_{\pi}} \left( \frac{Cr_t}{Cr_{t-1}} \right)^{\phi_{cr}} e^{e^R_t}
   \]

   Where: \( R_t \) – policy interest rate at \( t \), \( \pi_t \) – inflation rate at \( t \), \( Cr_t \) – credit cycle variable (credit growth or change in credit-to-GDP), \( e^{e^R_t} \) – monetary policy shock, \( \phi_R, \phi_{\pi}, \phi_{cr} \) – interest rate inertia, inflation weight and credit cycle weight coefficients respectively. Variables with an asterisk represent the steady state levels.

3. We estimate the loss function value in case of different oil price shock volatilities.
• We take simulations of the DSGE model for different sizes of oil-price shock (s.e. from baseline model, multiplied by 1, 2, 5, 10, 20, 50 and 100) and different weight of the credit cycle variable in MP rule (from 0 to 1 in increments of 0.1)

• In each case we calculate loss function values for different shocks and weights without using Leaning Against the Wind principle in MP rule and with LAW

• We calculate the relative loss function as the ratio of losses with the LAW to the losses without it for the same shock size and the same weight. If this ratio is smaller than one, we can conclude, that monetary policy benefits from considering the credit cycle.
Figure 5. Relative loss function in case of the credit-to-GDP ratio in monetary policy for equal weights of output, inflation and credits in loss function.

Relative losses, credit to GDP, $\alpha_{cr}=1$
Figure 6. Relative loss function in case of the credit-to-GDP ratio in monetary policy for equal weights of output, inflation and credits in loss function

Relative losses, credit growth, $\alpha_{cr}=1$
Figure 7-10. IRF of interest rate (left column) and real credit (right column) for $\phi_{cr} = 0.1$ (top row) and $\phi_{cr} = 0.5$ (bottom row)
• IRF analysis in panel VARs and LPMs finds that not all commodity-exporting countries included in the estimation reduce interest rates in response to higher oil prices: only emerging market economies do. Real credit tends to grow after a positive shock in commodity-exporting EMEs, but tends to decline in all other country groups.

• In the DSGE model we show that LAW outperforms IT when commodity price shocks become a relatively important source of volatility, thus supporting our empirical findings.

• Even when the financial stability risks associated with the volatility of credit developments are negligible, a moderate leaning against the wind policy is still preferable

Agénor, Pierre-Richard and Luiz A Pereira da Silva, Integrated inflation targeting - Another perspective from the developing world, BIS, 2019


Bank of International Settlements (BIS), Moving forward with Macroprudential frameworks, Chapter IV, Annual economic report, 2018


González, Andrés, Franz Hamann, and Diego Rodríguez. "Macroprudential policies in a commodity exporting economy." CBRT, the BIS or the IMF. (2016): 69.


Svensson, Lars EO. "How Robust Is the Result That the Cost of ‘Leaning against the Wind’Exceeds the Benefit?.." (2017b).
Variables: GGDP – Global GDP; ComPI – Commodity Price Index for non-exporting inflation targeting countries, and prices of Oil, Metals, Copper and Precious metals for exporting countries, depending on the commodity they export; GDP; Inflation (derived from the consumer price index); Nominal policy rate of a central bank; Credit. Credit and GDP variables are seasonally adjusted. All series except interest rates are in log differences. In addition, data standardisation is carried out.

Vector autoregression model (VAR) is:

\[ Y_t = \alpha + \Phi_1 Y_{t-1} + \cdots + \Phi_p Y_{t-p} + \varepsilon_t \]

Where \( t = 1, \ldots, T \) denotes time, \( Y_t \) is a \( q \times 1 \) vector of variables. Following Kilian and Lewis (2011) we choose a conventional ordering in a Cholesky decomposition: from external variables (global GDP and commodity prices) to domestic variables:

\[ Y_t = (GGDP_t, \text{ComPI}_t, GDP_t, \text{Inflation}_t, \text{Policy rate}_t, \text{Credit}_t)' \]

\[ \varepsilon_t \sim N(0, \Omega) \]
Vector autoregression model (VAR) is:

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\[ Y_t = (GGDP_t, ComPI_t, GDP_t, Inflation_t, Policy rate_t, Credit_t)' \]

\[ \varepsilon_t \sim N(0, \Omega) \]
Local projection model (LPM), following Jorda (2005), is:

\[ s = [0 : h] \]

In \( s = 0 \) evaluates:

\[
y_{t+0} = \alpha + B_1^1 y_{t-1} + \cdots + B_p^1 y_{t-p} + C_0 X_t + u_{t+0}^0
\]

\[
\text{IRF}_0 = C_0 d_j
\]

Where \( d_j \) represents the ‘structural shock’ to the \( j^{th} \) element in \( y_t \).

In \( s = 1: h \) evaluates:

\[
y_{t+s} = \alpha + B_1^{s+1} y_{t-1} + \cdots + B_p^{s+1} y_{t-p} + u_{t+s}^s
\]

We obtain

\[
\text{IRF}_1 = B_1^1 C_0 d_j
\]

\[
\vdots
\]

\[
\text{IRF}_s = B_1^s C_0 d_j
\]

where

\[
y_{t+s} = (\text{GGDP}_{t+s}, \text{ComPI}_{t+s}, \text{GDP}_{t+s}, \text{Inflation}_{t+s}, \text{Policy rate}_{t+s}, \text{Credit}_{t+s})'
\]

\[
X_t = \text{ComPI}_t
\]

and \( t = 1, \ldots, T \) denotes time, \( y_{t+s} \) is a \( q \times 1 \) vector of variables. \( X_t \) is a variable of commodity price index.
Figure 11-13. Comparison of relative loss functions for different weights of credits in loss function, credit growth, baseline volume of shock (left), 2 times higher (right), 50 times higher (bottom)
Figure 14-16. Comparison of relative loss functions for different weights of credits in loss function, credit-to-GDP, baseline volume of shock (left), 2 times higher (right), 50 times higher (bottom)
Figure 17-19. Comparison of relative loss functions for different weights of output in loss function, credit-to-GDP and credit weight 0, baseline volume of shock (left), 2 times higher (right), 50 times higher (bottom)
Figure 20-22. Comparison of relative loss functions for different weights of output in loss function, **credit-to-GDP and credit weight 1**, baseline volume of shock (left), 2 times higher (right), 50 times higher (bottom)
Figure 23-25. Comparison of relative loss functions for different weights of output in loss function, **credit growth and credit weight 0**, baseline volume of shock (left), 2 times higher (right), 50 times higher (bottom)
Figure 26-28. Comparison of relative loss functions for different weights of output in loss function, credit growth and credit weight 1, baseline volume of shock (left), 2 times higher (right), 50 times higher (bottom)