Macroeconomic Uncertainty Indicators for Russia

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Uncertainty: A multitude of macroeconomic effects...

- Disincentives for investment in the presence of fixed costs (a “real options” effect)

- Disincentives for consumption through a rise in precautionary savings

- Tighter financial constraints (a “financial frictions” effect)
... and a multitude of possible indicators

• Financial proxies, e.g. VIX (Bloom, 2009)
  
  ...but financial uncertainty does not always correlate with macroeconomic uncertainty

• Economic policy uncertainty (EPU): media-based indices popularized by (Baker, Bloom, Davies, 2012), number of expiring items in tax codes per year, dispersion of public spending forecasts; related concept: geopolitical risk indices (GPR by Caldara, Iacovello, 2019)

• Uncertainty as ‘unforecastability’ of economic variables: non-parametric (e.g. based on dispersion of forecasts by experts/ firms)
  
  ...but expert forecasts may be subject to systematic bias

  or parametric – based on standard deviation of model forecast errors (Jurado, Ludvigson, Ng, 2015)
Existing body of literature on uncertainty for Russia relatively scarce

- (Rautava, 2013): quarterly squared change in value of currency basket as a proxy; negative impact on output, imports and real exchange rate

- (Fedorova et al., 2019) construct an indicator of Russian policy uncertainty (RPUI) accounting for sanctions and trade restrictions on top of ‘traditional’ policy uncertainty terms; negative impact on Russian financial indicators is confirmed

- (Naidyonova, Leontieva, 2020) demonstrate negative impact of Russia’s EPU on investment at the firm level

- (Afanasyev et al., 2021): sentiment of Trump’s tweets concerning Russia positively correlates with ruble exchange rate
Macroeconomic uncertainty indicator based on (Jurado et al., 2015) (1)

Aggregate uncertainty as a weighted average of uncertainties of individual economic variables from a large dataset, defined as conditional volatilities of the purely unforecastable component of the future value of the series

\[ U_t(h) = \sum_j w_j U_t^{(j)}(h), \quad U_t^{(j)}(h) = \sqrt{E \left[ \left( y_{t+h}^{(j)} - \hat{y}_{t+h|t}^{(j)} \right)^2 \right]} . \]

... for h=1 approximated through forecast errors of factor-augmented forecasting models

\[ y_{t+1}^{(j)} = \rho(L)y_t^{(j)} + \beta(L)F_t + \gamma(L)F_{1,t} + \delta(L)W_t + \zeta(L)G_t + e_{t+1}^{(j)} \]

\( F_t \) – first principle components from \( \{ y^{(j)} \} \), \( W_t \) – first principle components from \( \{(y^{(j)})^2\} \), \( G_t \) – exogenous variables
Macroeconomic uncertainty indicator based on (Jurado et al., 2015) (2)

For h>1, uncertainty is calculated recursively, assuming autoregressive factor dynamics and stochastic volatility of errors (both for economic variables and factors)

\[ e_{t+1}^{(j)} = \sigma_{j,t}^{y} \epsilon_{j,t}^{y}, \quad \epsilon_{j,t}^{y} \sim i.i.d \ N(0,1), \quad \ln\sigma_{j,t}^{y} = \alpha_{j}^{y} + \beta_{j}^{y} \ln\sigma_{j,t-1}^{y} + \tau_{j}^{y} \eta_{j,t} \]

\[ \eta_{j,t} \sim i.i.d \ N(0,1) \]

Overall, uncertainty for h>1 has four components: (1) autoregressive component; (2) component due to volatility in predictors; (3) stochastic volatility; (4) covariance term for series and predictor errors
Data for Russia

• Monthly dataset 2004:01-2020:02 for 39 macroeconomic and financial variables (e.g. GDP, industrial production, freight turnover; employment by sector, real wages; retail trade; credit to households and businesses, monetary aggregates; exchange rate, external trade; CPI and PPI; interest rates, stock and bond indices)

• Pandemic period excluded due to 1) emergence of new common factors; 2) extremely high volatility that would dominate factor estimation throughout the entire period

• 8 common factors $F_t$ selected from $\{y^{(j)}\}$ based on (Bai, Ng, 2002) criteria, accounting for 57% in variation. 1$^{st}$ factor: 18%, large weights on government bond yields, credit interest rate. 2$^{nd}$ factor: 12%, large weights of GDP, manufacturing, freight turnover
Estimation of uncertainty for Russia

• Exogenous variables: oil prices, sanction intensity index by (Omelchenko, Khrustalev, 2018), VIX

• Four lags initially included in $y_{t+1}^{(j)} = \rho(L)y_t^{(j)} + \beta(L)F_t + \gamma(L)F_{1,t}^2 + \delta(L)W_t + \zeta(L)G_t + \epsilon_{t+1}^{(j)}$, with only regressors significant at 1% level eventually preserved. Estimates of $\epsilon_{t+1}^{(j)}$ used to construct 1-month-ahead uncertainty and to estimate stochastic volatility equation through Markov chain Monte Carlo methods

• $\alpha_j, \beta_j, \tau_j$ estimates are then used to assess uncertainty for farther horizons
Estimation results: month-, quarter- and year-ahead uncertainty
Uncertainty estimates: properties

- More persistent and countercyclical compared to many other uncertainty proxies

<table>
<thead>
<tr>
<th></th>
<th>u1</th>
<th>u3</th>
<th>u12</th>
<th>RVI</th>
<th>EPU</th>
<th>RPUI</th>
<th>GPR</th>
<th>SU</th>
<th>OILV</th>
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<tbody>
<tr>
<td>AR(1) coefficient</td>
<td>0.94</td>
<td>0.91</td>
<td>0.81</td>
<td>0.79</td>
<td>0.19</td>
<td>0.76</td>
<td>0.41</td>
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<tr>
<td>corr(*, u1)</td>
<td>1</td>
<td>0.98</td>
<td>0.89</td>
<td>0.87</td>
<td>0.02</td>
<td>-0.06</td>
<td>0.29</td>
<td>0.34</td>
<td>0.49</td>
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<td>0.31</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>corr(*, GDP_{t+1})</td>
<td>-0.33</td>
<td>-0.27</td>
<td>-0.17</td>
<td>-0.25</td>
<td>0.27</td>
<td>0.55</td>
<td>0.07</td>
<td>0.18</td>
<td>-0.51</td>
</tr>
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- Role of common uncertainty in individual series uncertainty higher in recessions and increases with horizon: average $R^2$ rises from 26% for $u1$ to 49% for $u12$
Uncertainty: impact on economic dynamics

- VAR model with 4 endogenous (GDP, CPI, 1-year government bond yield, uncertainty) and 3 exogenous (oil prices, sanctions intensity, VIX) variables; 6 lags for endogenous, 3 for exogenous

- Uncertainty ranked last in Cholesky decomposition, following (Ludvigson et al., 2021) evidence that macro uncertainty is rather a shock propagation channel than the main source of shocks itself

- Alternative uncertainty indicators: GPR, EPU, OILV
Impulse response functions
## Share of GDP variance explained by uncertainty indicators, %

<table>
<thead>
<tr>
<th>Horizon, months</th>
<th>u1</th>
<th>u3</th>
<th>u12</th>
<th>GPR</th>
<th>EPU</th>
<th>OILV</th>
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<td>6,7</td>
<td>6,5</td>
<td>0,7</td>
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<td>8,2</td>
<td>6,4</td>
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<td>7,7</td>
<td>8,4</td>
<td>13,2</td>
<td>2,3</td>
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Conclusions

• Estimated uncertainty indicators have a long half-life compared to alternatives and demonstrate negative impacts on output and price stability

• Impact of uncertainty shocks on output persistent: no return to the ‘pre-shock’ level

• Important questions for macroeconomic policies:
  - do uncertainty shocks reduce the effectiveness of countercyclical fiscal and monetary measures?
  - and, the other way around, can countercyclical policies dampen uncertainty shocks?
Thank you for your attention!