Balance Sheet Channel of Monetary Policy: Evidence from Credit Spreads of Russian Firms

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Abstract

- I test the relationship between ***external finance premium*** of Russian firms (proxied by credit spreads) and ***monetary policy shocks***
- In the presence of financial imperfections (for example, costly state verification), the inverse relationship between ***net worth*** and ***external finance*** premium arises (Bernanke et al. (1999))
- Balance sheet channel of monetary policy suggests that ***monetary shocks*** may affect net worth of a firm through ***interest payments***
- Thus, external finance premium of ***more indebted companies*** is more sensitive to monetary policy shocks.
- However, my empirical findings from *distributed lag model and local projections model* ***don't support*** this hypothesis.

Literature

Macro-level

- *Gertler and Karadi (2015)* estimate an SVAR model using high frequency surprises of interest futures as an external instrument. They find that monetary shocks have a large and continuous effect on credit spreads.

Micro-level

- *Ottonello and Winberry (2020)* demonstrate that **firms with lower default risk** – and hence, with better financial positions – **are more responsive** to monetary policy in terms of their investments. However, *Cloyne et al. (2018)* show that **younger firms** (that are supposed to be more financially constrained) **react** to monetary shocks by decreasing their investment **more**.
- *Anderson and Cesa-Bianchi (2020)* utilize credit spreads and firm-level balance sheet data. They found that the effect on credit spreads of more financially constrained firms is relatively ***more pronounced***. The authors use an ***event-study approac*h** which is not applicable in the context of Russia, because many bonds traded on the market are relatively illiquid.

Model

The framework of Bernanke et al. (1999) (in simplified interpretation of David Romer (‘Advanced macroeconomics’, 2011))

- *A Risk-neutral entrepreneur* undertakes a project that requires $\mathbf{1}$ unit of resources. He has wealth of $\boldsymbol{N}$, so he borrows $\boldsymbol{B} = \mathbf{1} - \boldsymbol{N}$ from a financial intermediary.
- The intermediary (risk-neutral) faces opportunity costs equal to the risk-free rate of return $\boldsymbol{R}$.
- Output $\boldsymbol{y}$ is distributed uniformly on $[\mathbf{0}, \mathbf{2}\boldsymbol{\gamma}]$.
- The authors assume a ***costly state verification problem***: if a borrower goes bankrupt, the lender needs to pay amount $\boldsymbol{c}$ in order to figure $\boldsymbol{y}$ out

Model (continued)

Problem

- The borrower maximizes his expected return s. to the lender's participation constraint:

$$\boldsymbol{R(D) = \frac{2\gamma - D}{2\gamma} D + \frac{D}{2\gamma}\left(\frac{D}{2} - c\right) = (1 + R)(1 - N)}$$

Solution

- In my thesis, I get an additional result that in this setting, the credit spread (that I define in the model's terms as $\frac{exprected\ payoff}{borrowed\ amount} - 1\ - R$) is an increasing function of the key rate R and the higher a firm's leverage, the larger the reaction to changes in R.
- This heterogeneity in responsiveness to monetary shocks is exactly what I test with my empirical model

Data

- I get bond data from **Cbonds** (the entire population of issuers).
- I get financial filings from **Cbonds** and **Spark** (primarily, IFRS, and when not available – national accounting standard).
- Sample period: ***September, 2013 – December, 2020***

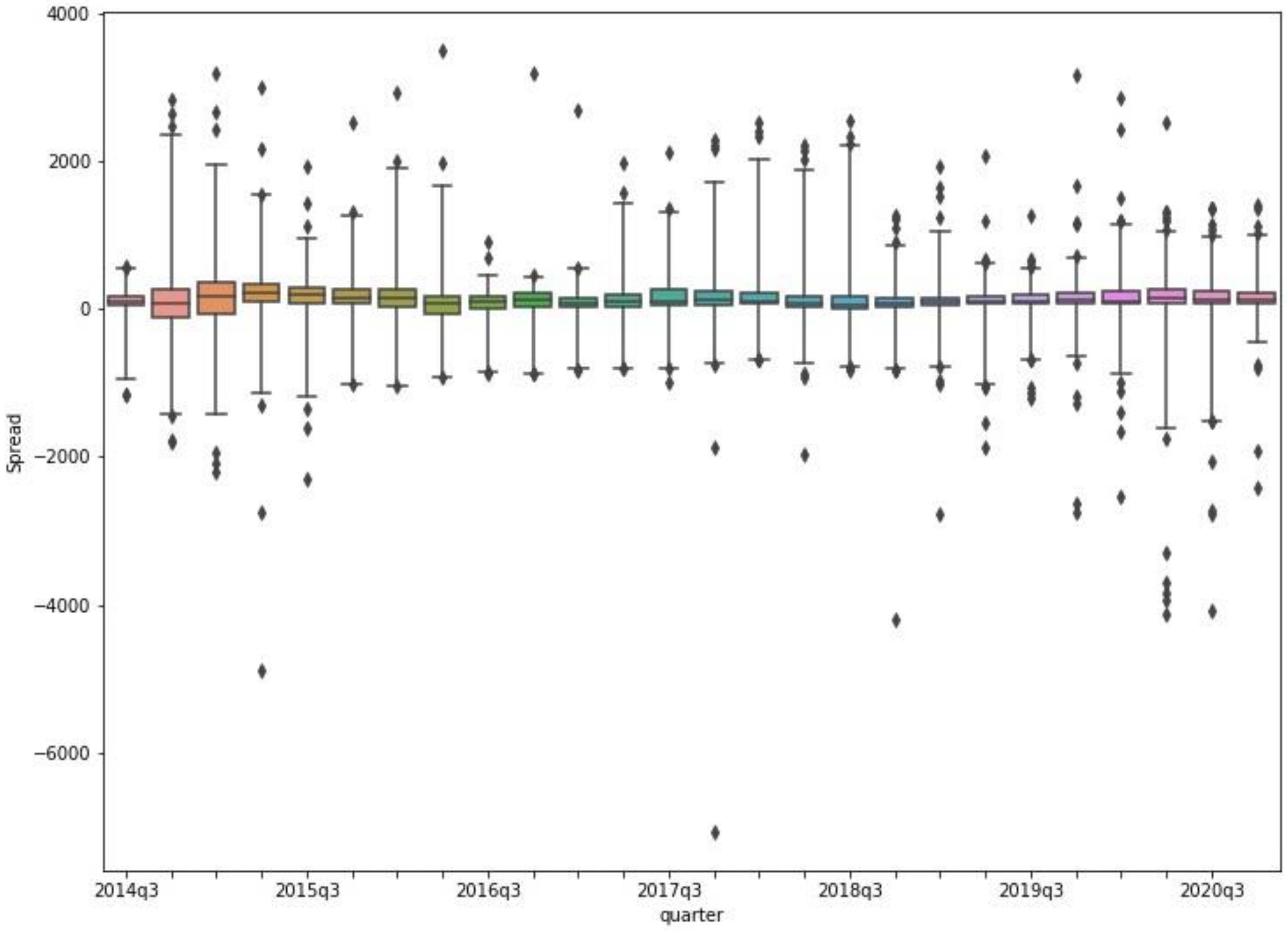
Table 5: Summary statistics, final sample

	mean	sd	p5	p50	p95	N
spread	408.851	5271.394	-413.073	123.474	864.916	8624
leverage (total assets over net worth)	292.573	2515.098	0.306	2.058	430.840	1652
leverage (debt over total assets)	0.646	0.253	0.234	0.673	0.998	1652
net worth	182.139	579.884	0.014	18.073	650.932	1653
total assets	398.401	1301.420	1.254	63.053	1255.562	1661
cash	11.415	31.137	0.000	0.664	55.654	1564
maturity	2004.050	1363.395	728.000	1820.000	3640.000	464
coupon rate	0.092	0.033	0.001	0.090	0.145	464
duration	648.080	581.113	26.000	507.435	1793.170	464
amount outstanding	8.659	13.46	0.20	5	25.00	464

- I excluded bonds with **oferta (an embedded option)** and **financial institutions** from the sample → 120 firms
- **Oferta:** a combination of put and call features → effectively makes it a series of short-term bonds

Data (continued)

- The key variable *Spread* is measured as g-spread (the difference between a bond's yield and the corresponding point on g-curve).

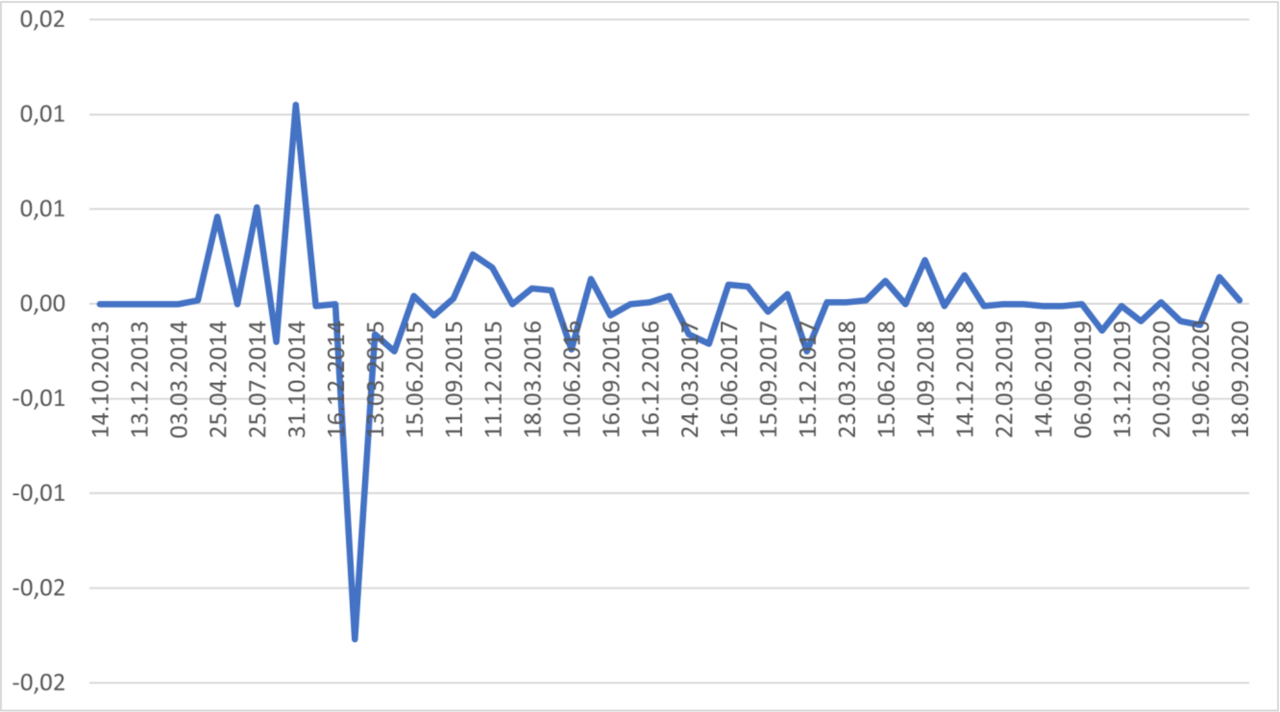


Monetary Shocks

- ***Monetary shocks*** are calculated as the difference between the announced rates and *consensus policy rate forecasts* of macro analysts (Bloomberg surveys)
- ***Identification assumption***: analysts have access to the same information on the current economic conditions and assess it effectively
- **Suggestive evidence:**

  a) no serial correlation (Durbin-Watson statistic = 2.5 $\in [1.5; 2.5]$)

  b) zero mean (p-value = 0.31)



Estimation

- **Distributed lag model:**

$$\boldsymbol{Spread_{it} = \beta_0 + \sum_{p=0}^{11} \beta_p \times Leverage_{it-12} MonetaryShock_{t-p} + X_{it-12} + \alpha_t + \alpha_i + \epsilon_{it} (1),}$$

where $\boldsymbol{X_{it}}$ is the set of controls: the 12th lags of Net Worth, Size, Leverage and Cash;

α_t and α_i -- fixed effects;

standard errors are clustered at the firm level

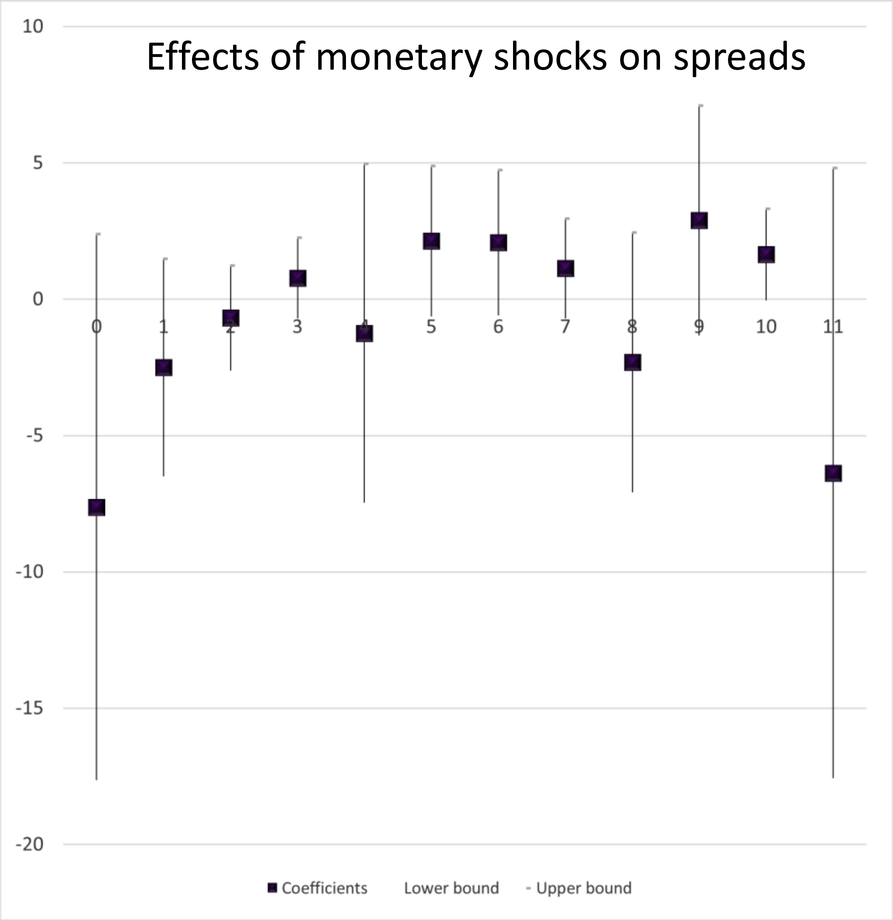
- Specifications (2) – (4) include also $\sum_{p=0}^{11} \beta_p \boldsymbol{Size_{it-12}} \times MonetaryShock_{t-p}$, $\sum_{p=0}^{11} \beta_p \boldsymbol{NetWorth_{it-12}} \times MonetaryShock_{t-p}$ and $\sum_{p=0}^{11} \beta_p \boldsymbol{Cash_{it-12}} \times MonetaryShock_{t-p}$

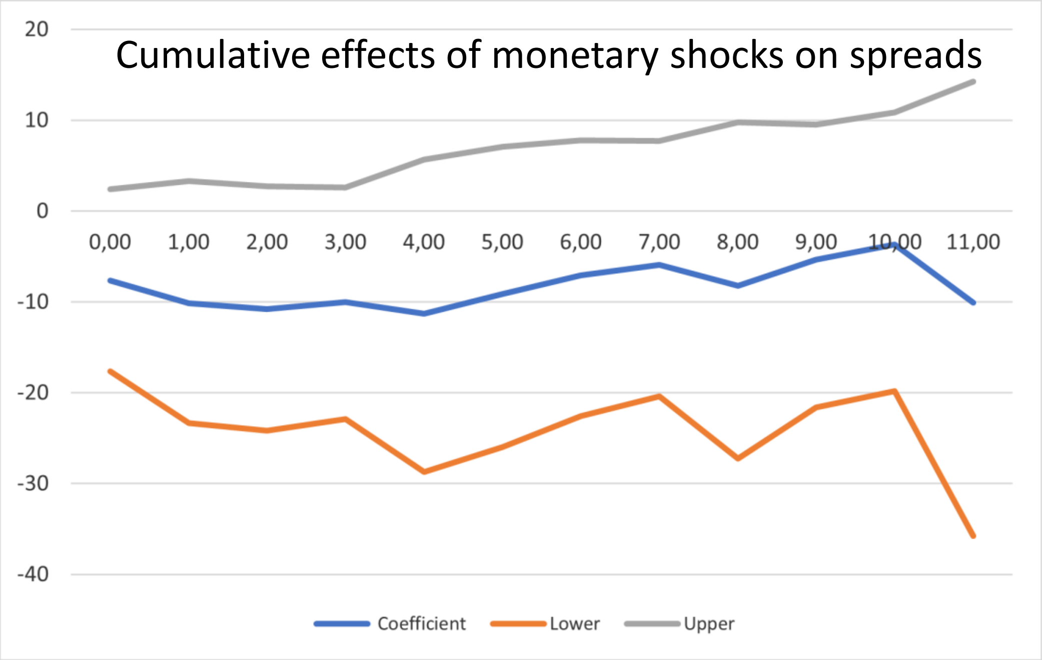
Table 6: Baseline Models

	(1)	(2)	(3)	(4)
$leverage_{t-12} \times MonetaryShock_t$	-7.624	-5.831	-8.150	-6.389
	(5.113)	(4.711)	(5.645)	(4.439)
$leverage_{t-12} \times MonetaryShock_{t-1}$	-2.503	0.230	-2.410	-1.973
	(2.034)	(1.592)	(2.387)	(2.019)
$leverage_{t-12} \times MonetaryShock_{t-2}$	-0.684	2.189	0.142	-0.725
	(0.988)	(2.878)	(1.637)	(1.162)
$leverage_{t-12} \times MonetaryShock_{t-3}$	0.781	-3.105	0.091	0.399
	(0.756)	(3.135)	(0.777)	(0.629)
$leverage_{t-12} \times MonetaryShock_{t-4}$	-1.245	-1.700	-1.203	-0.741
	(3.172)	(2.808)	(3.161)	(2.944)
$leverage_{t-12} \times MonetaryShock_{t-5}$	2.135	4.552	2.764	2.430
	(1.412)	(3.535)	(1.673)	(1.656)
$leverage_{t-12} \times MonetaryShock_{t-6}$	2.076	1.424	1.809	1.975
	(1.360)	(1.891)	(1.337)	(1.383)
$leverage_{t-12} \times MonetaryShock_{t-7}$	1.137	-4.899	0.256	0.638
	(0.935)	(4.962)	(1.086)	(0.950)
$leverage_{t-12} \times MonetaryShock_{t-8}$	-2.306	1.196	-1.745	-1.944
	(2.434)	(1.721)	(2.374)	(2.287)
$leverage_{t-12} \times MonetaryShock_{t-9}$	2.896	4.601	3.112	3.135
	(2.154)	(3.520)	(2.222)	(2.253)
$leverage_{t-12} \times MonetaryShock_{t-10}$	1.647*	-1.835	1.550*	1.269
	(0.862)	(2.025)	(0.822)	(0.775)
$leverage_{t-12} \times MonetaryShock_{t-11}$	-6.375	-8.637	-6.263	-6.455
	(5.711)	(8.179)	(5.743)	(5.865)
N	3093	3093	3093	3093
R^2	0.4822	0.4830	0.4833	0.4827
F-test	-	0.52	0.48	0.44

Estimation (continued)

- **Results**

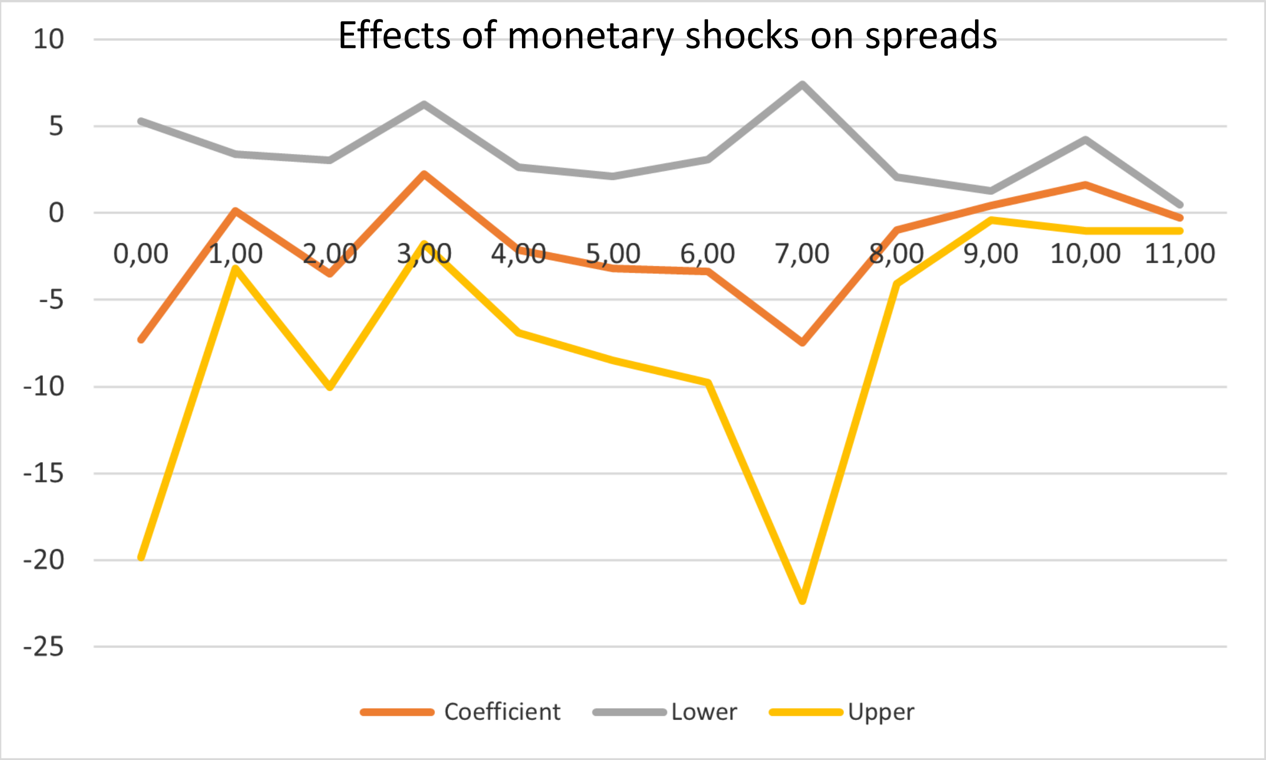




Estimation (continued)

- Local Projection:

$$Spread_{i,t+h} = \beta_0 + \alpha_i^h + \alpha_t^h + \beta_1^h \, Leverage_{i,t-1} \, MonetaryShock_t + X_{it-1} + \epsilon_{i,t+h} \quad (2)$$



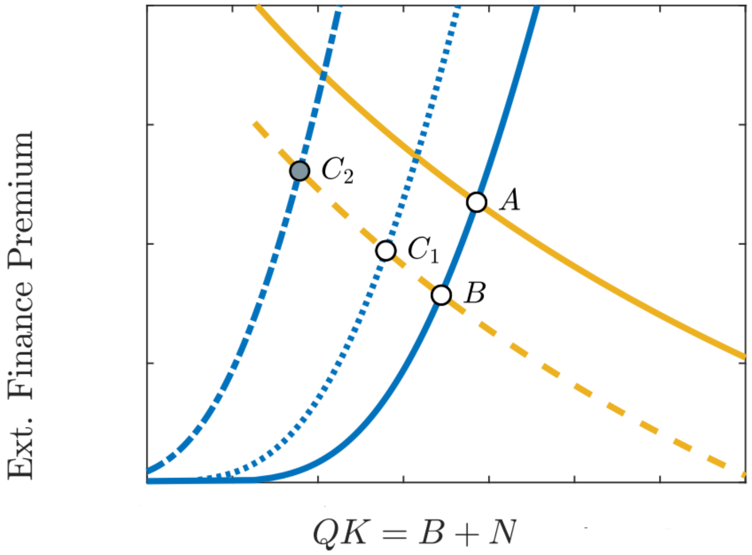
Robustness checks

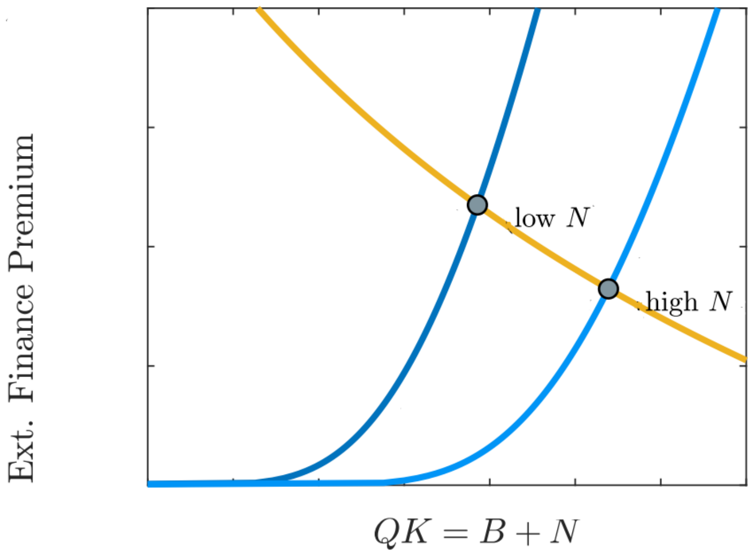
- I reestimate model (1) on the sample that includes bonds with oferta. This allows to increase the sample from 3093 date-firm points to 5403 and from 110 firms to 166 entities. Results do not change (Appendix 1).
- I reestimate model (1) without the controls (X_{it}). Results do not change (Appendix 2).
- Ottonello and Winberry (2020) argue that the observed heterogeneity may be driven by the permanent heterogeneity across firms ($E_i[leverage_{it}]$). So, they demean leverage in their empirical test in order to avoid OVB. I repeat their procedure and the main conclusions do not change (Appendix 3).

Discussion

- Yellow line – demand for capital: $\frac{R_k}{R} = \frac{1}{R}\left(\alpha K_t^{\alpha-1} + \frac{Q'(1-\delta)}{Q}\right)$
- Blue line – credit supply schedule: $EFP \equiv \frac{R_k}{R} = f\left(\frac{QK}{N}\right)$ $(QK = N + B)$, $f'(x) > 0$
- Both supply and demand are affected by monetary policy. A new equilibrium may be at the point C_1 or C_2

Anderson and Cesa-Bianchi (2020)





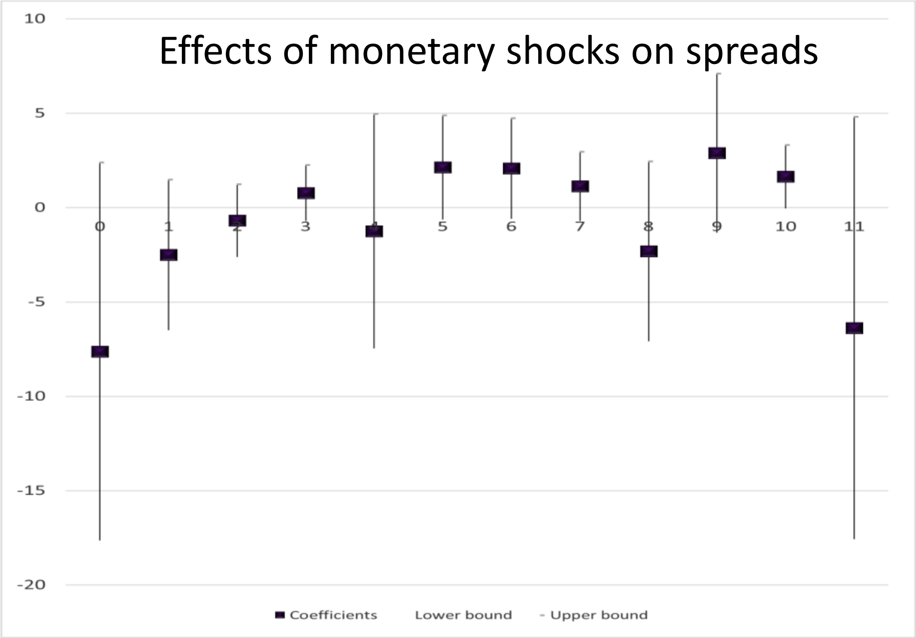
Discussion

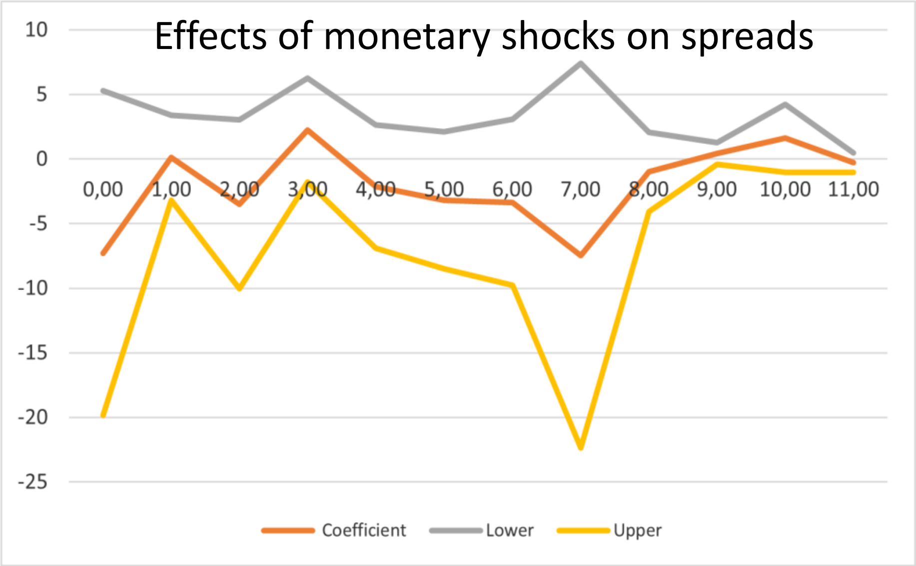
Selection bias:

- Some firms defaulted on their bonds before they matured (did not pay a coupon) and didn't get into the final sample (14 firms)→ the estimates may be biased towards zero: these firms are likely to be more responsive to monetary shocks.

BUT

- This concerns model (1) which is estimated on bonds that experienced all 12 monetary shocks, but not the estimates of model (2) (at small lags).





Conclusion

- Results of the estimation suggest that there is ***no statistically significant heterogeneity*** in the reaction of Russian bond issuers' external finance premium on monetary shocks.
- This doesn't support
  - the theoretical results of Bernanke et al. 1999 and Boivin et al. 2011
  - empirical papers of Anderson and Cesa-Bianchi (2020).
- To the best of knowledge, this is one of the first works that studies credit spreads at the microlevel within an emerging economy.
- These results suggest that regardless of financial structure (leverage) the premium for external financing reacts to monetary shocks in the same way. It means that the decision-making process of Bank of Russia concerned with the availability of external finance for Russian firms could be a little easier.

Appendix (1)

Table 10: Estimation on the sample that includes bonds with oferta

	(1)	(2)	(3)	(4)
$leverage_{t-12} \times MonetaryShock_t$	-2.036*	-1.365	-2.055*	-2.007*
	(1.188)	(1.251)	(1.230)	(1.199)
$leverage_{t-12} \times MonetaryShock_{t-1}$	1.369	2.217	1.328	1.211
	(1.326)	(2.077)	(1.554)	(1.281)
$leverage_{t-12} \times MonetaryShock_{t-2}$	-1.151	-2.028	-1.159	-1.131
	(1.201)	(2.265)	(1.279)	(1.279)
$leverage_{t-12} \times MonetaryShock_{t-3}$	-0.307	0.060	-0.391	-0.209
	(0.423)	(0.690)	(0.467)	(0.471)
$leverage_{t-12} \times MonetaryShock_{t-4}$	1.277*	0.709	1.439*	1.446*
	(0.723)	(0.615)	(0.759)	(0.768)
$leverage_{t-12} \times MonetaryShock_{t-5}$	0.073	0.250	0.187	0.222
	(0.586)	(0.689)	(0.610)	(0.657)
$leverage_{t-12} \times MonetaryShock_{t-6}$	-0.008	-1.282	-0.172	0.006
	(0.477)	(1.141)	(0.560)	(0.578)
$leverage_{t-12} \times MonetaryShock_{t-7}$	0.261	-1.229	0.169	0.282
	(0.615)	(1.548)	(0.624)	(0.651)
$leverage_{t-12} \times MonetaryShock_{t-8}$	0.331	1.243	0.370	0.456
	(0.876)	(1.304)	(0.891)	(0.898)
$leverage_{t-12} \times MonetaryShock_{t-9}$	-0.235	-0.035	-0.242	-0.198
	(0.301)	(0.717)	(0.321)	(0.349)
$leverage_{t-12} \times MonetaryShock_{t-10}$	0.208	-0.371	0.168	0.198
	(0.703)	(1.070)	(0.708)	(0.734)
$leverage_{t-12} \times MonetaryShock_{t-11}$	0.993	3.415	1.164	1.223
	(0.882)	(2.369)	(0.941)	(0.998)
N	5403	5403	5403	5403
R^2	0.3272	0.3278	0.3274	0.3274

Appendix (2)

Table 7: Models without additional controls (the twelfth lags of net worth, leverage, size and cash)

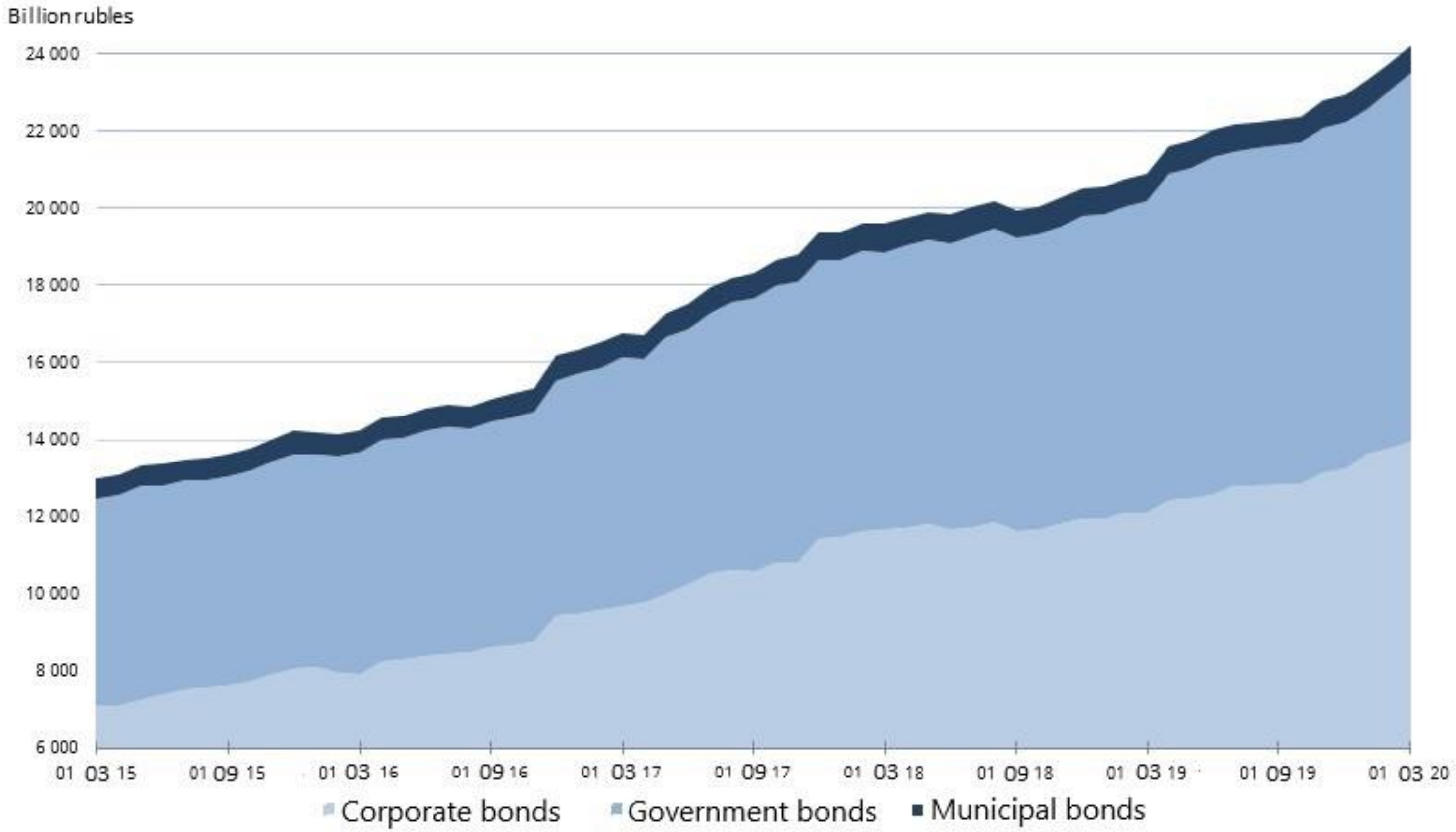
	(1)	(2)	(3)	(4)
$leverage_{t-12} \times MonetaryShock_t$	-7.570	-5.745	-8.052	-6.334
	(5.124)	(4.738)	(5.634)	(4.450)
$leverage_{t-12} \times MonetaryShock_{t-1}$	-2.456	0.302	-2.306	-1.942
	(2.042)	(1.598)	(2.380)	(2.020)
$leverage_{t-12} \times MonetaryShock_{t-2}$	-0.658	2.192	0.168	-0.692
	(1.010)	(2.853)	(1.651)	(1.181)
$leverage_{t-12} \times MonetaryShock_{t-3}$	0.807	-3.095	0.108	0.433
	(0.767)	(3.164)	(0.785)	(0.635)
$leverage_{t-12} \times MonetaryShock_{t-4}$	-1.225	-1.685	-1.171	-0.714
	(3.183)	(2.827)	(3.173)	(2.953)
$leverage_{t-12} \times MonetaryShock_{t-5}$	2.143	4.564	2.767*	2.437
	(1.407)	(3.512)	(1.668)	(1.652)
$leverage_{t-12} \times MonetaryShock_{t-6}$	2.100	1.447	1.825	2.000
	(1.356)	(1.853)	(1.331)	(1.377)
$leverage_{t-12} \times MonetaryShock_{t-7}$	1.157	-4.875	0.266	0.656
	(0.941)	(5.004)	(1.092)	(0.955)
$leverage_{t-12} \times MonetaryShock_{t-8}$	-2.293	1.219	-1.740	-1.930
	(2.438)	(1.760)	(2.377)	(2.301)
$leverage_{t-12} \times MonetaryShock_{t-9}$	2.902	4.633	3.120	3.146
	(2.153)	(3.509)	(2.222)	(2.249)
$leverage_{t-12} \times MonetaryShock_{t-10}$	1.666*	-1.820	1.567*	1.282
	(0.876)	(2.110)	(0.837)	(0.797)
$leverage_{t-12} \times MonetaryShock_{t-11}$	-6.364	-8.639	-6.253	-6.451
	(5.724)	(8.246)	(5.756)	(5.881)
N	3093	3093	3093	3093
R^2	0.4822	0.4830	0.4833	0.4827

Appendix (3)

Table 9: Estimation with the demeaned leverage

	(1)	(2)	(3)	(4)
$leverage_{t-12} \times MonetaryShock_t$	0.736	3.863	1.114	3.285
	(5.387)	(8.019)	(5.705)	(8.456)
$leverage_{t-12} \times MonetaryShock_{t-1}$	-2.240	-1.120	-2.295	-2.660
	(2.410)	(3.351)	(2.738)	(2.787)
$leverage_{t-12} \times MonetaryShock_{t-2}$	0.636	-4.606	-5.411	-0.611
	(3.948)	(4.478)	(8.633)	(4.628)
$leverage_{t-12} \times MonetaryShock_{t-3}$	2.213	3.996	7.453	4.483
	(2.337)	(6.119)	(7.484)	(4.254)
$leverage_{t-12} \times MonetaryShock_{t-4}$	0.939	1.551	2.943	2.563
	(1.607)	(4.174)	(3.024)	(2.454)
$leverage_{t-12} \times MonetaryShock_{t-5}$	-2.302	-2.368	-6.841	-4.965
	(3.184)	(5.986)	(7.159)	(5.137)
$leverage_{t-12} \times MonetaryShock_{t-6}$	-1.412	1.949	0.566	-0.418
	(2.258)	(3.114)	(2.848)	(1.858)
$leverage_{t-12} \times MonetaryShock_{t-7}$	0.824	3.810	9.088	4.544
	(2.767)	(4.259)	(9.397)	(5.786)
$leverage_{t-12} \times MonetaryShock_{t-8}$	0.891	-3.967	-5.335	-0.699
	(2.382)	(3.407)	(6.499)	(2.281)
$leverage_{t-12} \times MonetaryShock_{t-9}$	-4.114	1.030	-5.158	-7.004
	(2.698)	(4.670)	(3.757)	(4.580)
$leverage_{t-12} \times MonetaryShock_{t-10}$	-1.572	6.858	0.208	0.013
	(2.226)	(4.940)	(2.242)	(2.068)
$leverage_{t-12} \times MonetaryShock_{t-11}$	4.750	-4.707	2.862	3.220
	(3.541)	(6.666)	(2.980)	(3.083)
N	3093	3093	3093	3093
R^2	0.4802	0.4818	0.4815	0.4808

Appendix (4)



Billion rubles
24 000
22 000
20 000
18 000
16 000
14 000
12 000
10 000
8 000
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Corporate bonds
Government bonds
Municipal bonds