USING MICRODATA ON COMPANIES TO MONITOR FINANCIAL STABILITY

Alexander Novopoltsev,
Belarusian State University,
National Bank of Belarus

Minsk, 2018

Outline

- Motivation
- Problems discussion
- Case Studies by Data Sources
  - Balance Sheet Data
  - Credit Register Data
- What to do next

Motivation of research

- Assessment of financial vulnerability and credit risk of companies (Economic Analysis)
- Monitoring risks transmission from real sector to banking sector (Banks Supervision)
- Support policy decisions for Central Bank (Financial Stability and Monetary Policy Decisions)

Why microdata?

- Distribution of data instead of aggregates
  - Descriptive statistics
  - Tail risks
- Heterogeneous groups of economic agents
  - Industries, size of firms
  - Income groups of households

Issues Related to SOEs in Belarus

- SOEs - State-Owned Enterprises (2/3 of industrial production, half of employees, low efficiency)
- High level of Non-performing loans (NPL)
- Few companies listed on stock exchange and few have public credit ratings
- National Reporting standards
- Different definitions of default

Data sources

- NB Monitoring database of non-financial companies balance sheets
  - quarterly, since 2008
  - 2000 companies
  - 4 major industries
- Credit register of NB
  - Daily (if some changes in credit history)
  - 20k companies, 5m households
  - All types of credit contracts

Balance Sheet Data

Financial ratios analysis

- Liquidity indicators
- Solvency indicators
- Financial stability indicators
- Profitability indicators

  - Issues:
    - EBIT, EBITDA (etc.) approximation (due to national reporting standarts)

IMF financial distress indicator

A company in financial distress

if 2 criteria out of 3 doesn't hold:

1. [profitability]: Net profit
2. [liquidity]: Current assets > short-term liabilities (maturity less than one year)
3. [solvency]: Total assets > Total liabilities (equivalent to negative capital)

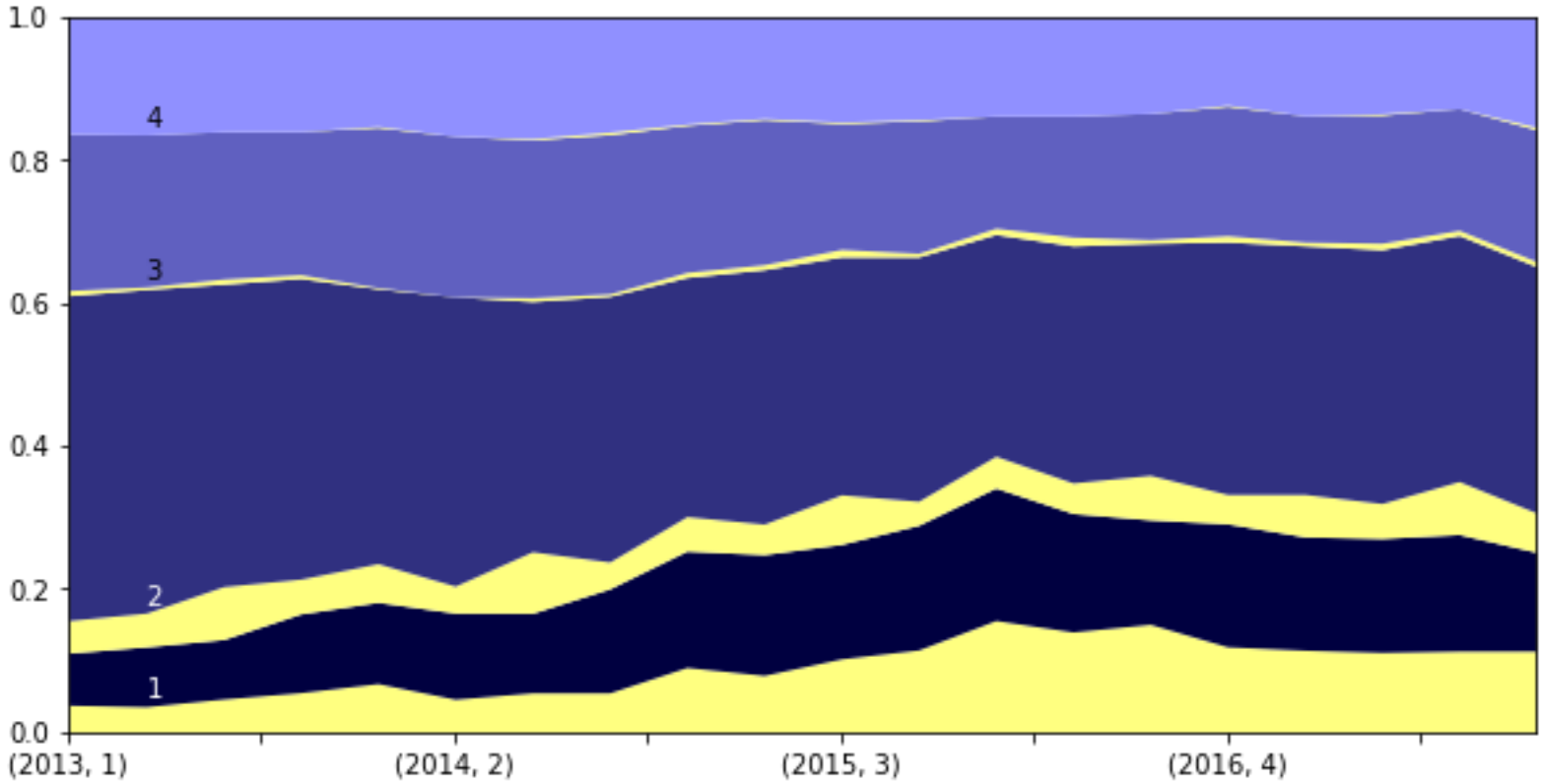
IMF criteria values: 1 – vulnerable, 0 - otherwise

Cluster analysis (Kmeans)

- 12 financial ratios
- Preparing data: calculating ratios, outliers detection, censoring and scaling to [0,1]
- Cluster analysis (K-means)
  - 4 clusters (1 – poor financial performance, 4 – best)
  - spatial data representation of panel dataset
- Discriminant Analysis on out-of-sample data
- Analysis of Macro-level indicators (average rating by sample of companies)

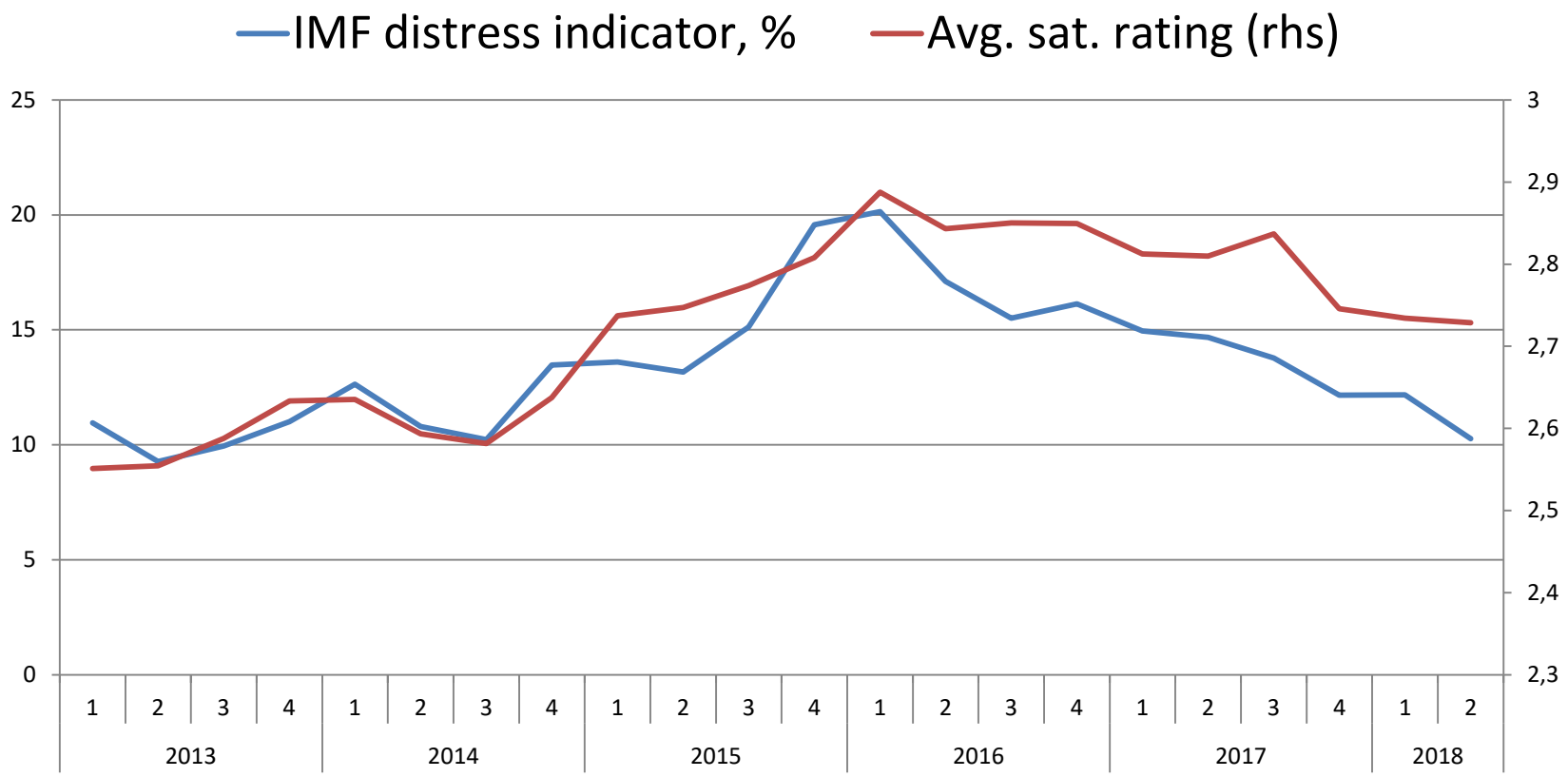
Kmeans criteria values: 1 – most vulnerable, 2-3 – medium, 4 - least

Distributions of vulnerable firms



- 500 State-owned enterprises
- Cluster analysis (1-4) and firms in distress by IMF criteria (yellow)

Mean criteria by quarter



- 500 State-owned enterprises
- inverted Kmeans indicator(4 – most vulnerable, 1 – least)
- average by group of entities in each quarter

Measuring the Riskiness of Credit Allocation

- Proposed by Greenwood and Hanson (2013)
- Applied in IMF Global Financial Stability Report (April 2018)

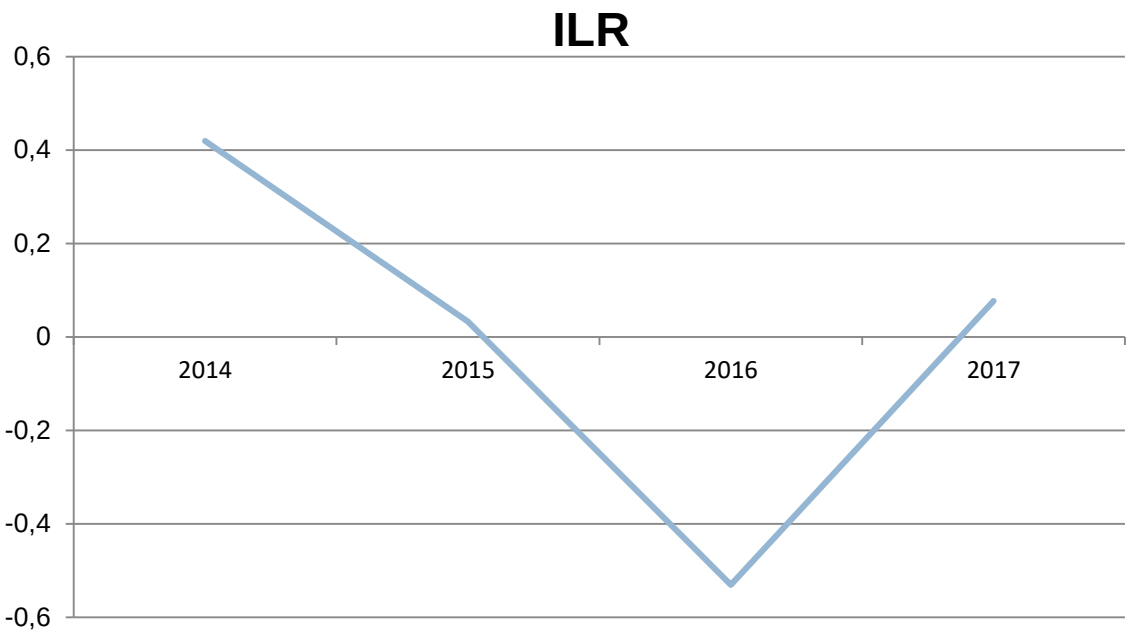
$d_{it} = \Delta D_{it} / A_{it-1}$ Debt issuance to lagged assets for firm *i* in year *t*

$IL_{it} = Total\_debt_{it} / Total\_assets_{it}$ Leverage

$$ILR_t = \frac{\sum_{i \in High d_{it}} IL_{it}}{N_t^{High d_{it}}} - \frac{\sum_{i \in Low d_{it}} IL_{it}}{N_t^{Low d_{it}}}$$

Leverage-based Riskness of credit allocation

Riskness of credit allocation



- 500 State-owned enterprises
- Leverage – based
- yearly data

Credit Register Data

Credit risk assessment organizations

- Ratings agencies
  - Companies listed on the Stock Exchange
  - Financial market decisions
- Commercial banks
  - Credit history data, balance sheet data
  - IRB approach (Internal Rating Based)
  - Making decision of issuing credit
- National Central Banks
  - Credit Register
  - Assessing banks vulnerabilities, capital and reserves adequacy, etc.

Credit register – economic agents

- Non-Financial Company
  - Number of state registration, VAT payer's number
  - Foundation date, Type of economic activity
  - region
- Household
  - Passport identification number
  - birthday, sex
  - Region

Credit register history

- Date of history changes
- Credit repayments (trigger events)
  - Debt outstanding
  - Payments overdue (on debt, interest, service)
  - Group risks (for reserves)
- Credit Contracts
  - Date of Issue and Repay (or Default)
  - Type of Contract and Collateral
  - Source of history (commercial bank)
- Requests to credit histories

Definitions of default

- Basel 2 Definition: “past due payments on debt and interest more than 90 days”
- Black-Sholes-Merton model (EDF – expected probability of default)
- Financial Ratios Based (Altman Z score, Taffler model, etc.)

Credit Register Data – Test Data

Credit Register statistics **by firm**

			Days past due	Debt outstanding	Contracts	Payments overdue	% Payments overdue
		End of	max	sum		sum	ratio
Firm ID	year	month	number	mln. BYN	number	mln BYN	%
13579	2013	5	28	560155.1	24	130898.6	23.4
		6	60	640746.0	24	157480.1	24.6
		7	91	621416.4	25	126047.6	20.3
		8	120	795806.5	24	112269.8	14.1
		9	152	769349.7	23	64215.6	8.3
		10	183	759329.5	22	68756.8	9.1
		11	211	758811.9	22	72178.1	9.5
		12	243	741008.8	22	92347.2	12.5

Credit Register – Test Data

Aggregated statistics for **group of firms**

year	End of month	Number of firms	Number of contracts	Debt outstanding	Payments	% Payments overdue
2013	**3**	3	4	0	0	
	4	1	1	0	0	
	5	10	124	3226807.76	920519.6	28.5
	6	10	128	3380720.12	1000167	29.6
	7	11	131	3397763.59	1080002	31.8
	8	12	123	4074056.73	1080756	26.5
	9	13	121	3669806.45	1199271	32.7
	10	12	115	3487501.87	1291834	37.0
	11	11	103	3028145.21	1184877	39.1
	12	12	103	2806761.94	1411114	50.3

What to do next

Farther Applications in Central Bank

- Analytical Reporting (for Economic Analysis)
- Assessing Credit Risk and Vulnerability of Commercial Banks (risk transmission from non-financial sector)
- Scoring model for companies
  - Benchmark for commercial banks
  - Economic analysis of causal effects

Scoring models data in Central Banks

- Household
  - Credit Register data (Already implemented in National Bank of Belarus)
- Non-Financial Company
  - Credit register data (dependent variable)
  - Balance sheet data (factors)

Farther Issues

- Availability of Data
  - Confidentiality issues
  - Bad Quality of Data
- Data manipulation issues
  - Lack of structured databases
  - Different Data formats
- Interpretation issues
  - Which methodology is correct?
  - Is Data Sample representative?
  - **How to adopt to Central Bank decisions?**

Principles

- Merging data from different sources
- Analytics as an alternative to modeling
- Maintaining Structured Databases
- Using Scripting languages for data manipulation and reporting (R, Python)
- Validating Results on Micro Data comparing to Macro aggregates (from Statistical Agency)

Thank you for attention!

Questions?