National Bank of Ukraine

THE GROWTH-AT-RISK (GaR) FRAMEWORK: IMPLICATION FOR UKRAINE

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The views of authors don’t necessarily represent the views of the National Bank of Ukraine

Motivation and Research Question

Motivation:

The main objective of this research is to contribute to developing the procedure of measuring the systemic risk to improve the process of macroprudential policymaking of the National Bank of Ukraine by applying and adapting the Growth-at-risk (GaR) framework to examine the macro-financial vulnerabilities, financial conditions, and other factors linked to the probability distribution of GDP growth in Ukraine.

Research question:

- Estimate the scope and consequences of large-scale downturns of GDP, under a given probability and time horizon, and to define factors that generated them.
- Explore the relationships between macrofinancial environment (financial conditions, credit and sectors` activity, and external conditions) and economic activity on different stages of Ukrainian economy.
- Examine the behavior of GDP growth distributions under different scenarios of economic development, as well as the historical ones, that have previously realized.

Motivation and Research Question

Policy implications:

- Enhances the existing methodology of assessing systemic risks and develop the procedure of measuring the systemic risk to improve the process of macroprudential policymaking;
- With the help of Growth-at-Risk measure, the NBU experts can assess the possibility and magnitude of adverse scenarios for the national economy, thus getting a proactive tool.
- With the help of derived future distribution of GDP growth, the NBU policymakers may enrich their forecasting tool that now is based on point-estimation to the scale of whole distribution.
- Helps to quantify the tradeoff between the tighter macroprudential conditions and, respectively, slower credit growth and financial stability.
- Helps to assess the applicability and relative usefulness of stress-testing baseline and adverse scenarios, thus contributing to fairer outcomes.
- With the help of GaR tool, it becomes simpler to communicate with the public on the risks to financial stability and the forecast of economic growth.

Methodology and Model (steps)

- I. Constructing indices which will represent three main explanatory variables of future GDP growth. These factors are:
  - Financial conditions index
  - Credit and Sectors Activity index
  - External conditions index
- II. Estimating quantiles regressions to identify the relationships between partitions and GDP growth.
- III. After estimating the pool of the quantile models, deriving GDP growth distribution via fitting a parametric form of a skewed t-distribution.
- IV. Based on the derived distribution of future GDP growth, conducting scenario analysis.

Methodology and Model (Model Specifications)

$$Q_\tau(Y_{t+q}) = \beta_0(\tau) + \beta_1(\tau)X_{t1} + \beta_2(\tau)X_{t2} + \beta_3(\tau)X_{t3} + Q_\tau(Y_t) + \varepsilon(\tau)_{t+q},$$ where

$Q_\tau(Y_{t+q})$ – GDP growth q period ahead (the quarter) at a particular percentile,

τ – percentile,

t- time,

q- quarter,

X_{t1}, X_{t2}, X_{t3} – financial conditions index, credit and sectors` activity, External conditions index,

$\beta_0, \beta_1, \beta_2, \beta_3$ – sets of parameters associated with the τth percentile,

$Q_\tau(Y_t)$ – GDP growth at the current period at a particular percentile (autoregressive term),

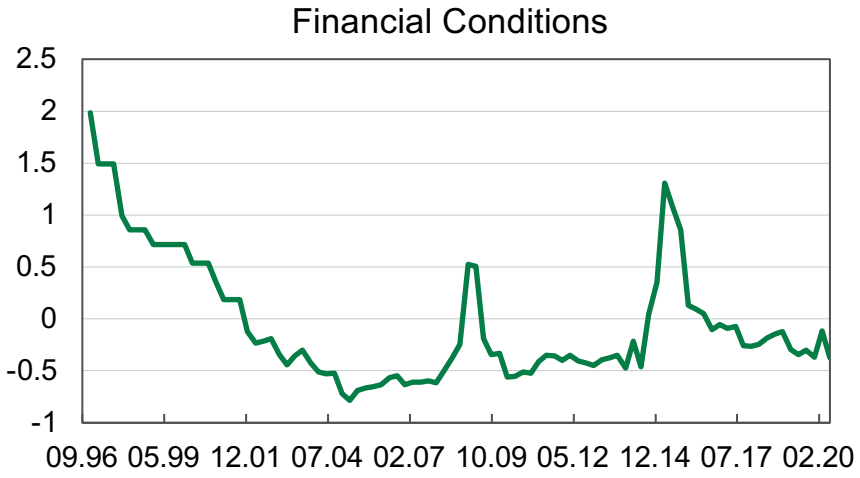
$\varepsilon(\tau)_{t+q}$ – residuals.

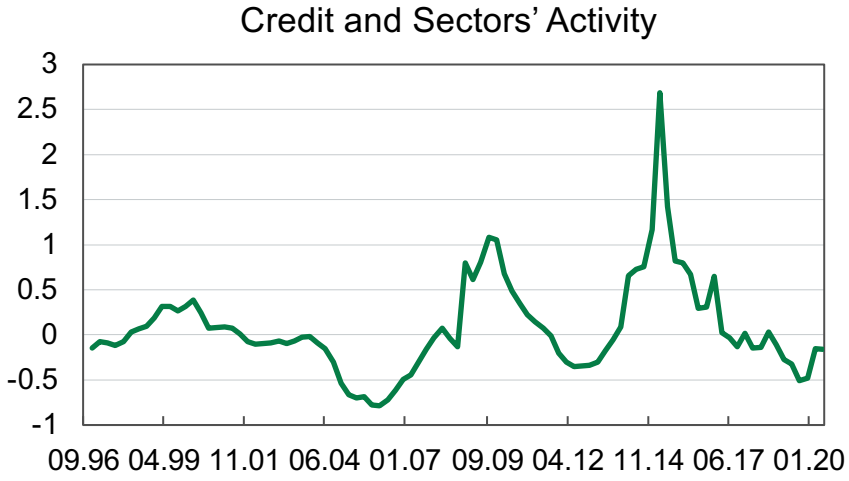
Step 1: Constructing indices. Variables

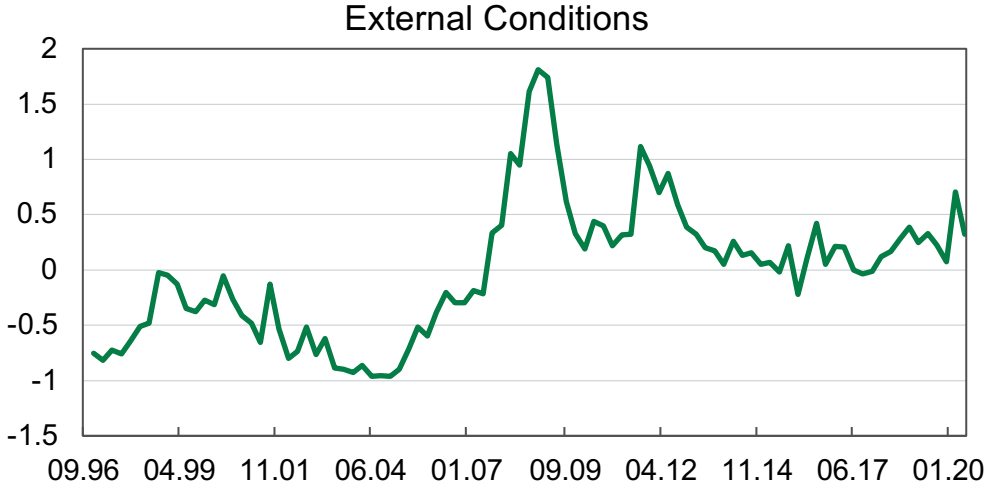
- We employed two approaches for constructing indices for the variables.
  - Aggregating variables inside each index with simple cross sectional average.
  - Conducting Principal Component Analysis which enables us to identify the relative importance of each indicator among one group of factors.
- We included the following indicators in the indices:

Financial Conditions	Credit and Sectors Activity		External Conditions	
Bond yields		Credit to GDP Gap	Dollarization	Credit dollarization
Corporate IR spread	Household	House price growth on a primary market, quarterly		Deposit dollarization
Household IR spread		House price growth on a secondary market, quarterly		FCI US
Corporate lending IR		PTR		CISS
HH lending IR		PTI		CA Deficit
RWA to Capital		HH debt to GDP		Commodity Prices (Index)
Corporate Eurobonds	Corporate	Corporate debt to GDP		GEPU Index
	Government	Public debt to GDP		
	Banking	Banks` leverage		
		Banks` ROA		
		Banks` ROE		

Step 1: Constructing indices. Cross-Sectional Average

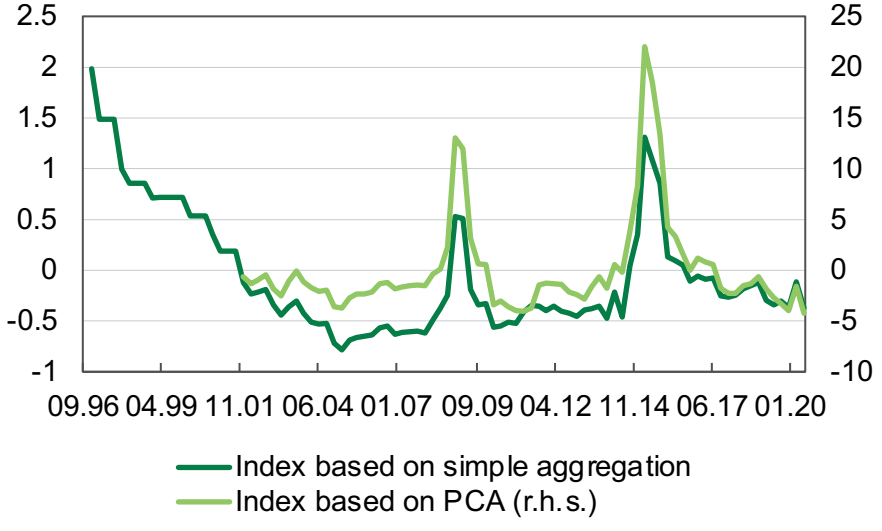




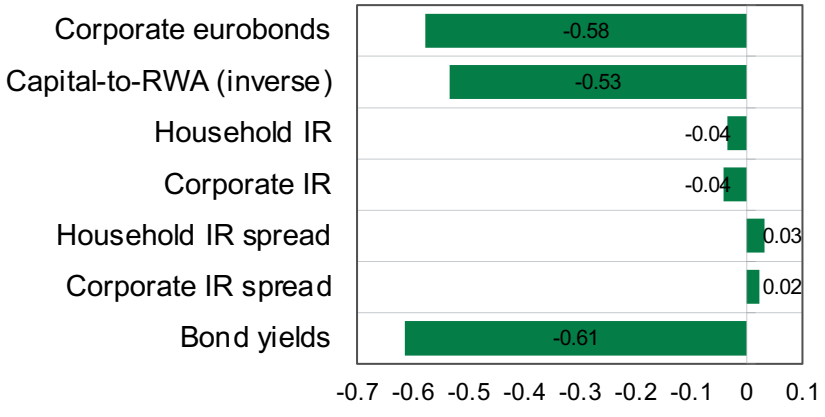


Step 1: Constructing indices. PCA. Financial Conditions. Short

Financial conditions partition (index)



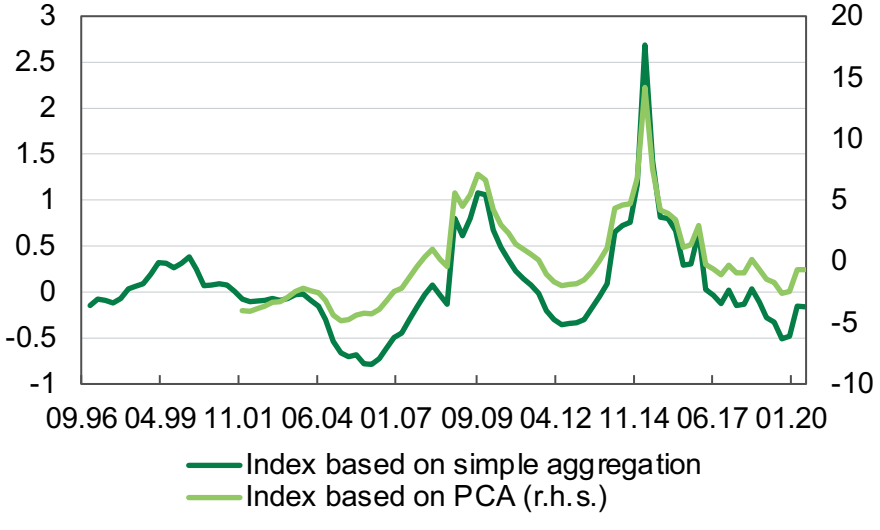
Relative contribution of the indicators



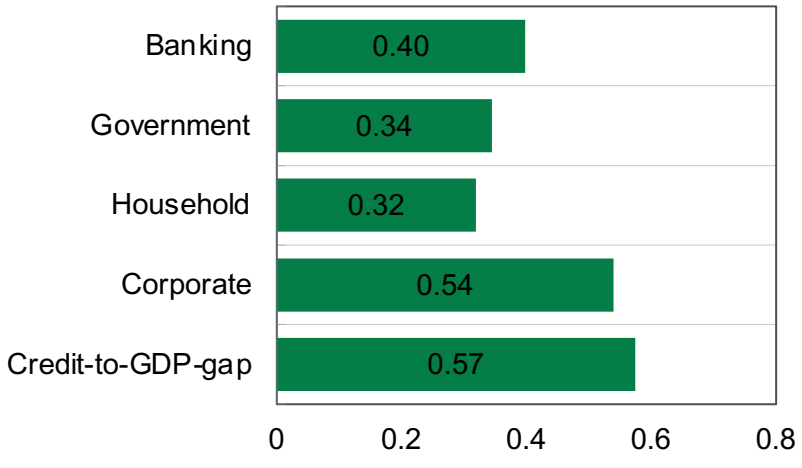
Note: The figure show indices dynamics for a shorter period than previous graphs due to data availability.

Step 1: Constructing indices. Credit and Sector` Activity

Credit and Sectors` Activity (index)

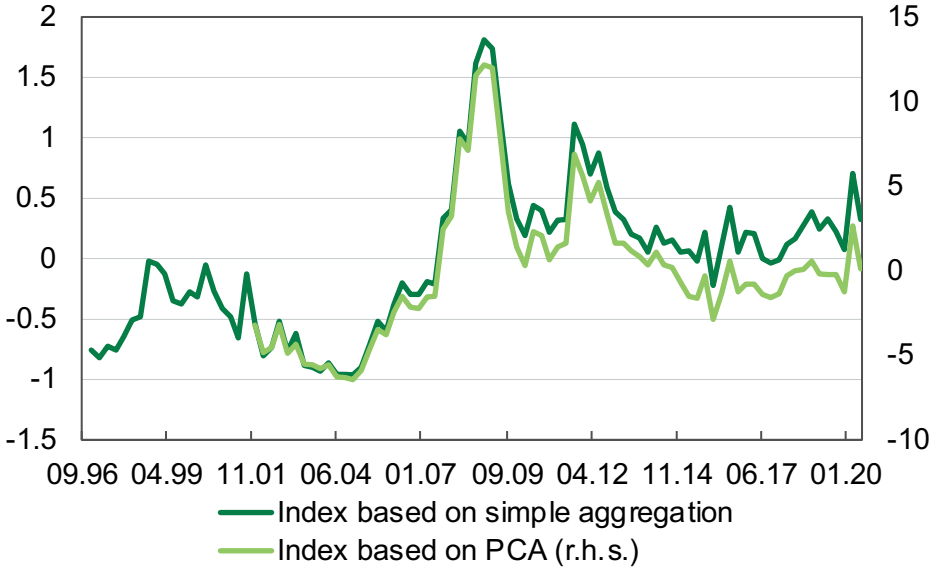


Relative contribution of the indicators

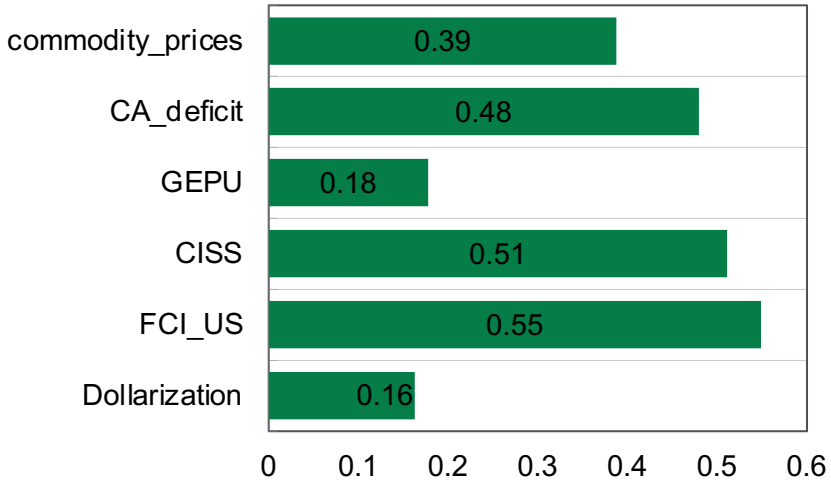


Step 1: Constructing indices. External conditions

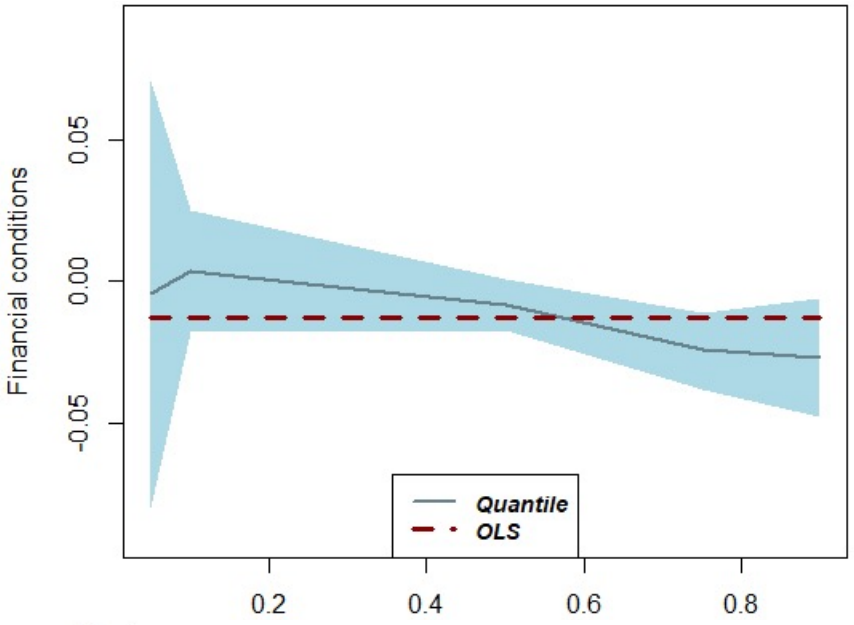
External conditions, index

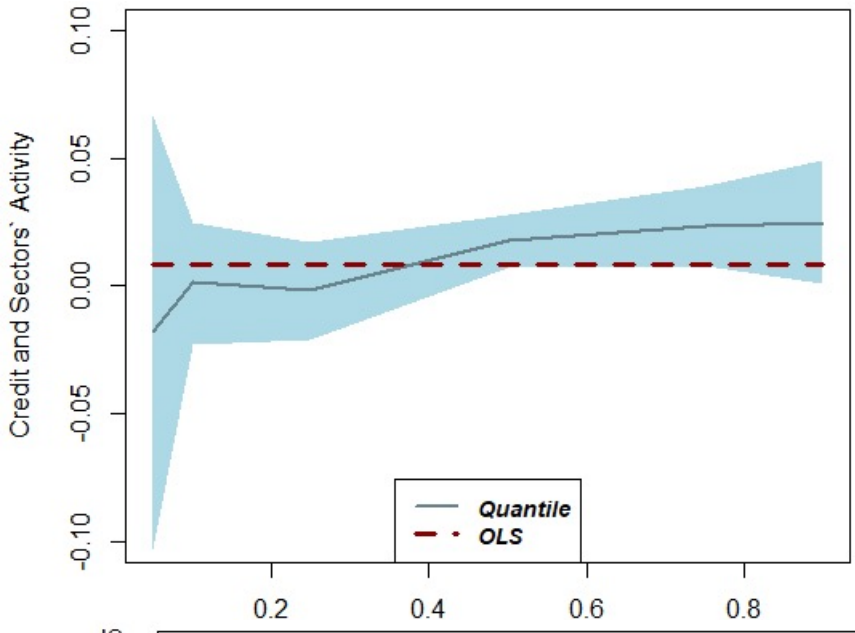


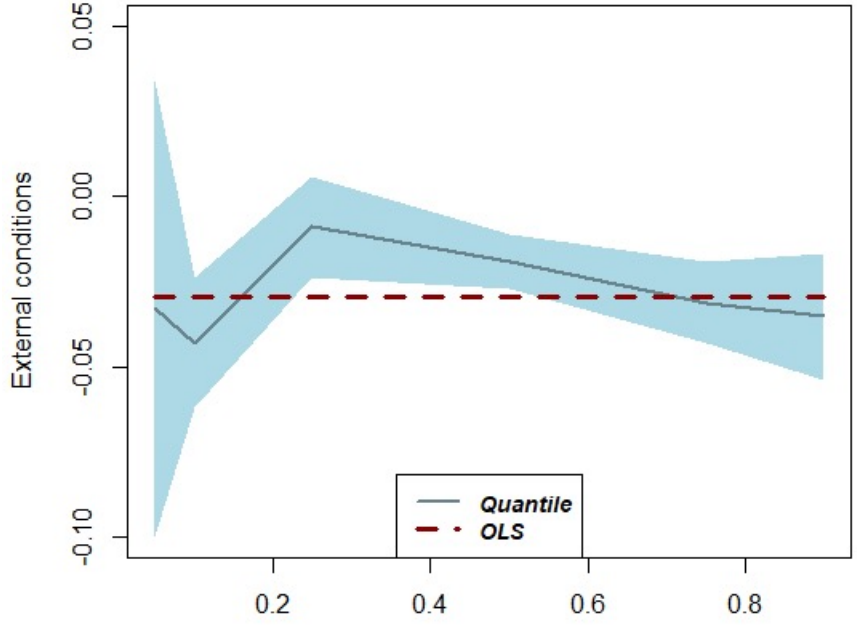
Relative contribution of the indicators

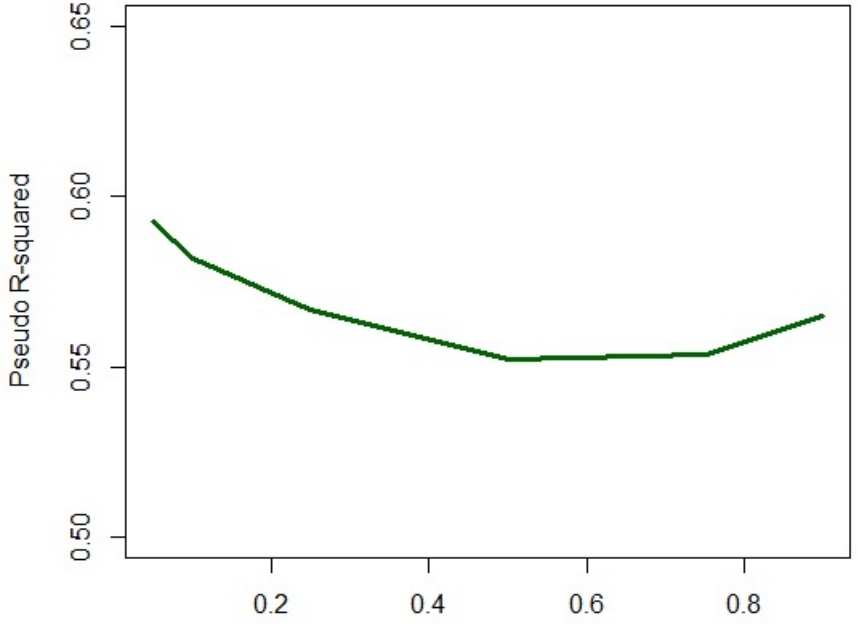


CSA, 1q ahead

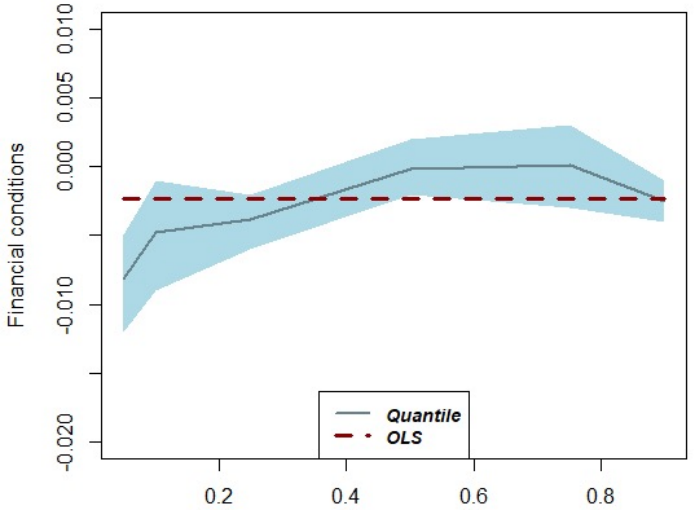

Financial conditions
0.05
0.00
-0.05
0.2
0.4
0.6
0.8
Quantile
OLS

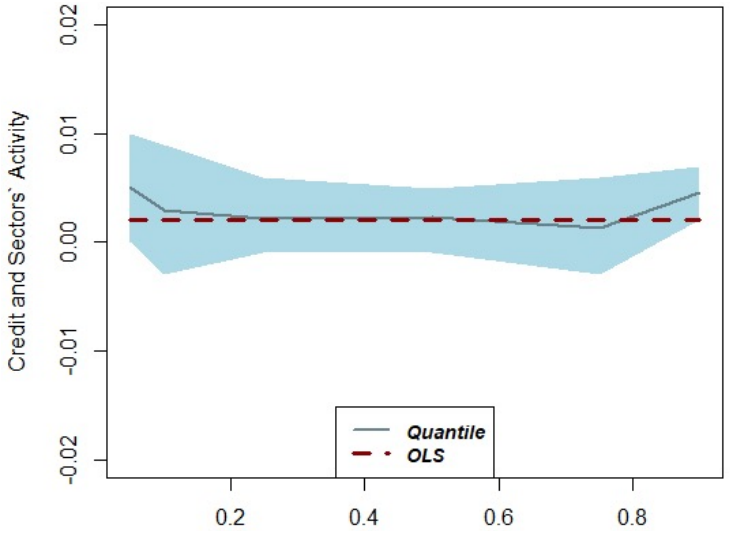

Credit and Sectors` Activity
0.10
0.05
0.00
-0.05
-0.10
0.2
0.4
0.6
0.8
Quantile
OLS

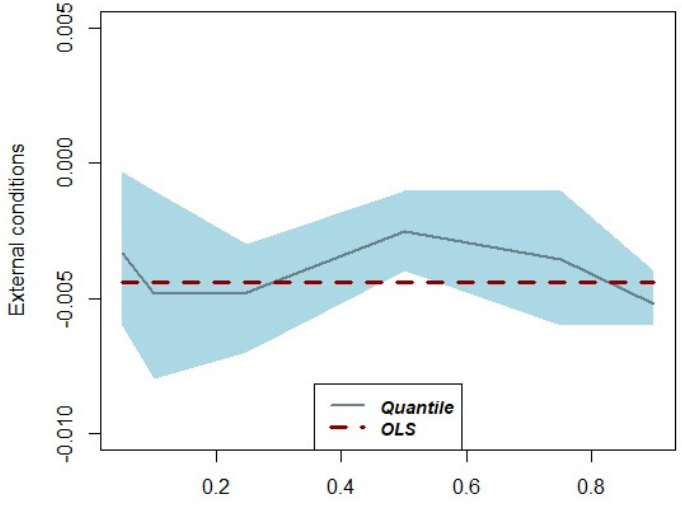

External conditions
0.05
0.00
-0.05
-0.10
0.2
0.4
0.6
0.8
Quantile
OLS

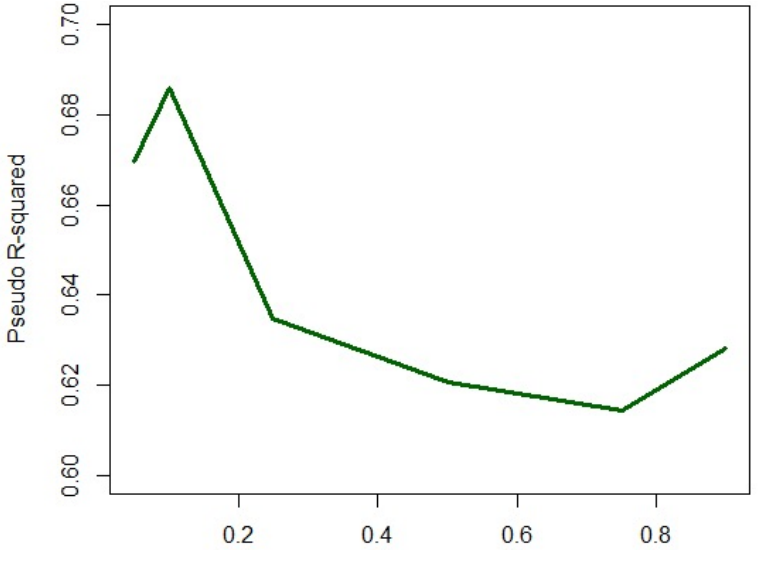

Pseudo R-squared
0.65
0.60
0.55
0.50
0.2
0.4
0.6
0.8

PCA, 1q ahead

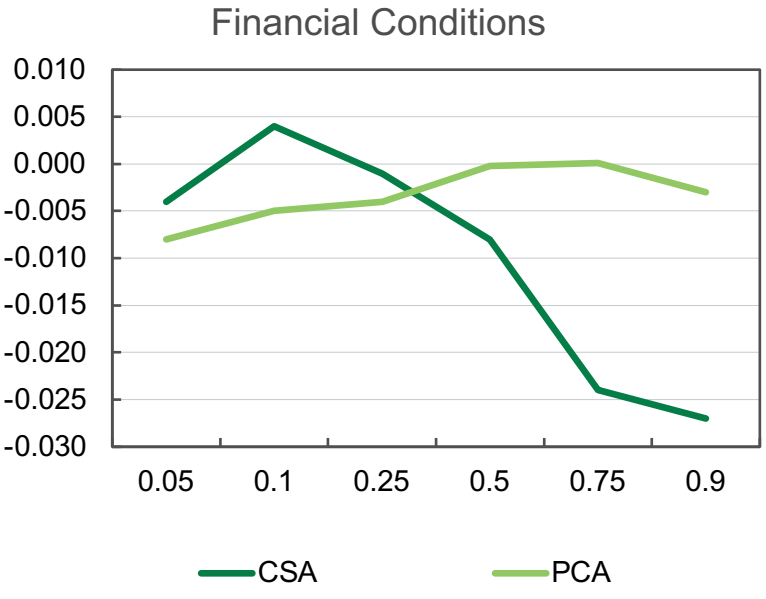

Financial conditions
0.010
0.005
0.000
-0.010
-0.020
0.2
0.4
0.6
0.8
Quantile
OLS

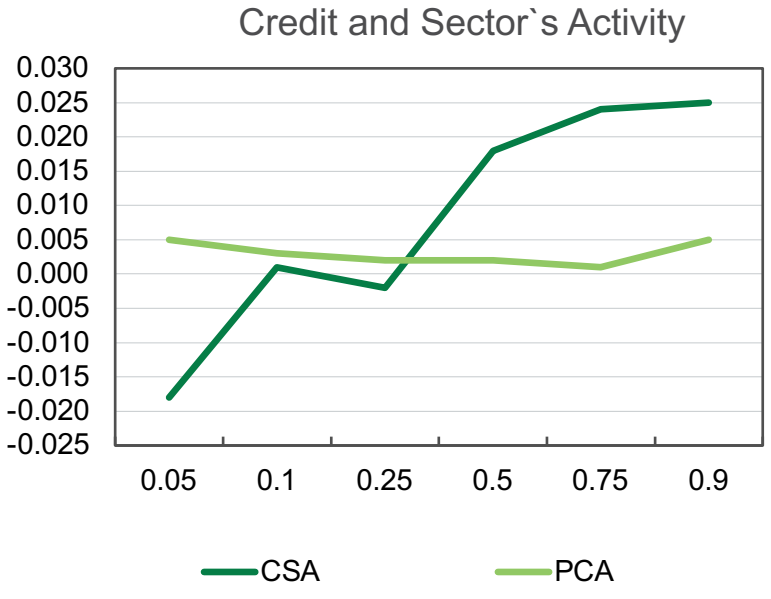

Credit and Sectors` Activity
0.02
0.01
0.00
-0.01
-0.02
0.2
0.4
0.6
0.8
Quantile
OLS

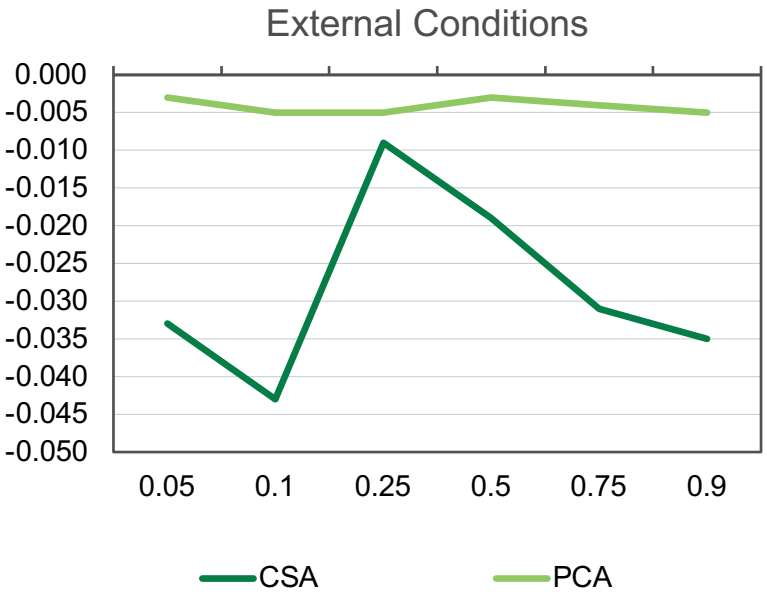

External conditions
0.005
0.000
-0.005
-0.010
0.2
0.4
0.6
0.8
Quantile
OLS


Pseudo R-squared
0.70
0.68
0.66
0.64
0.62
0.60
0.2
0.4
0.6
0.8

Model Comparison

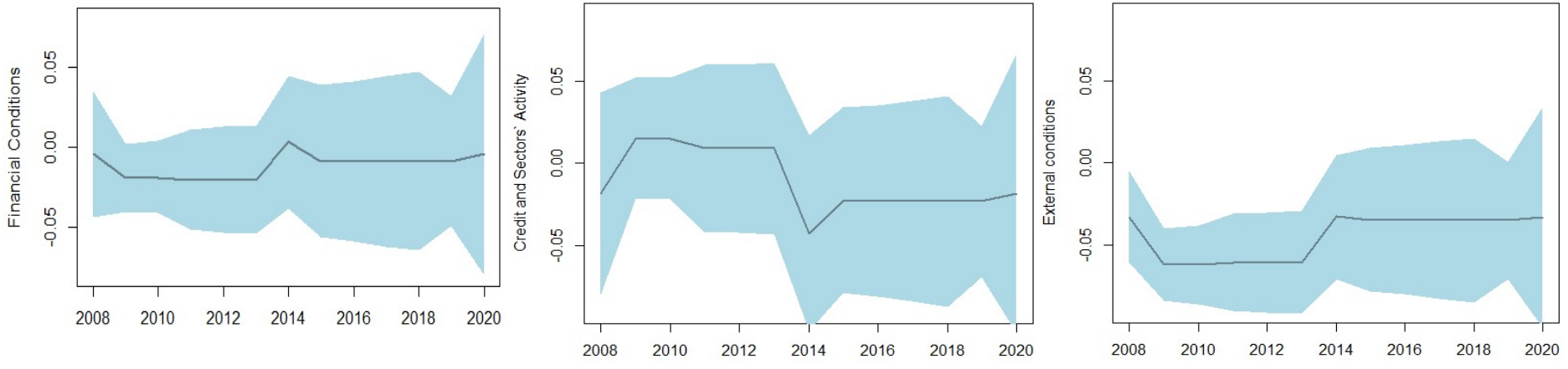




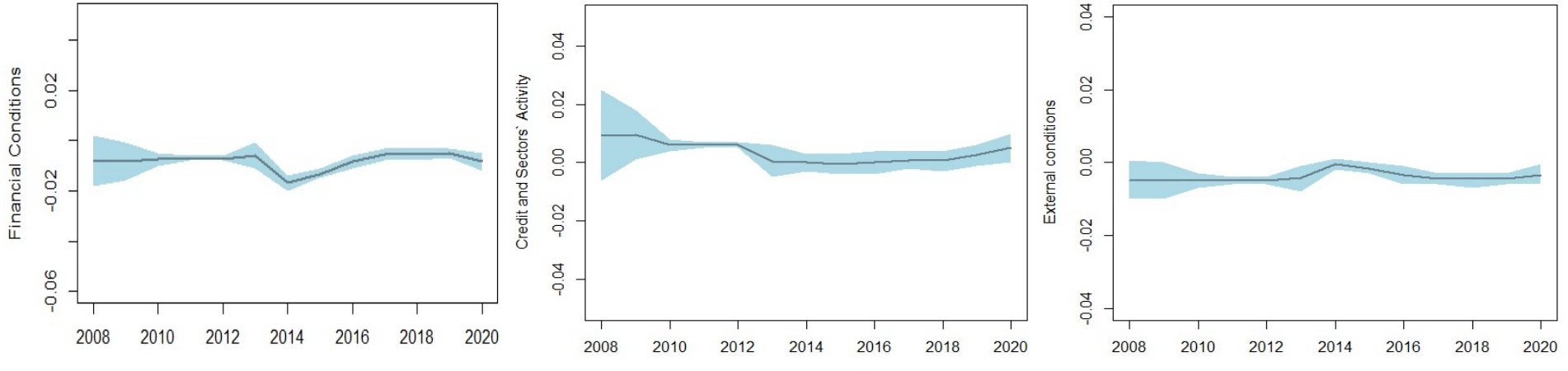


Coefficients' Stability, 5th percentile

Model under cross-sectional average



Model under principal component analysis

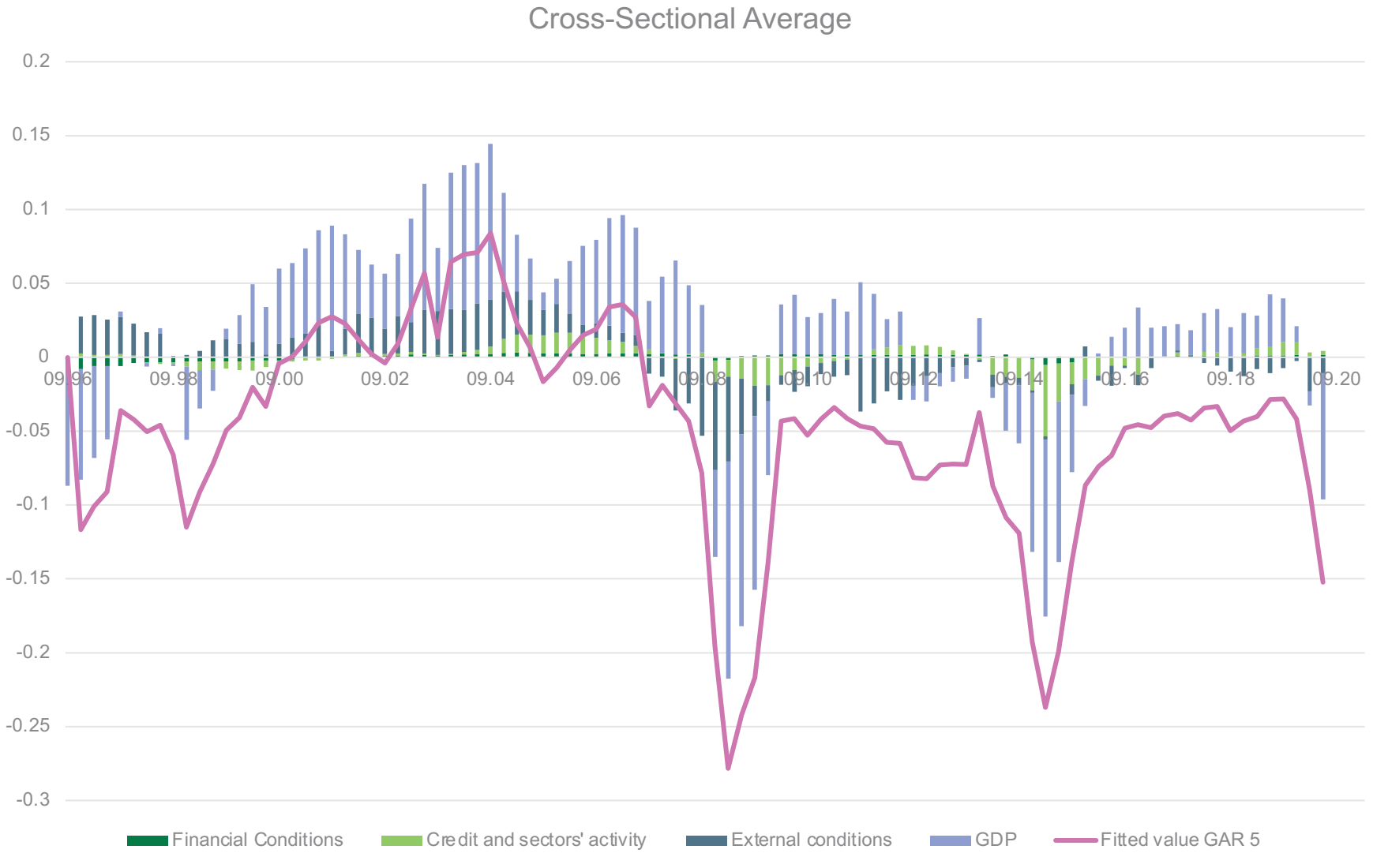


Coefficients on different time horizons

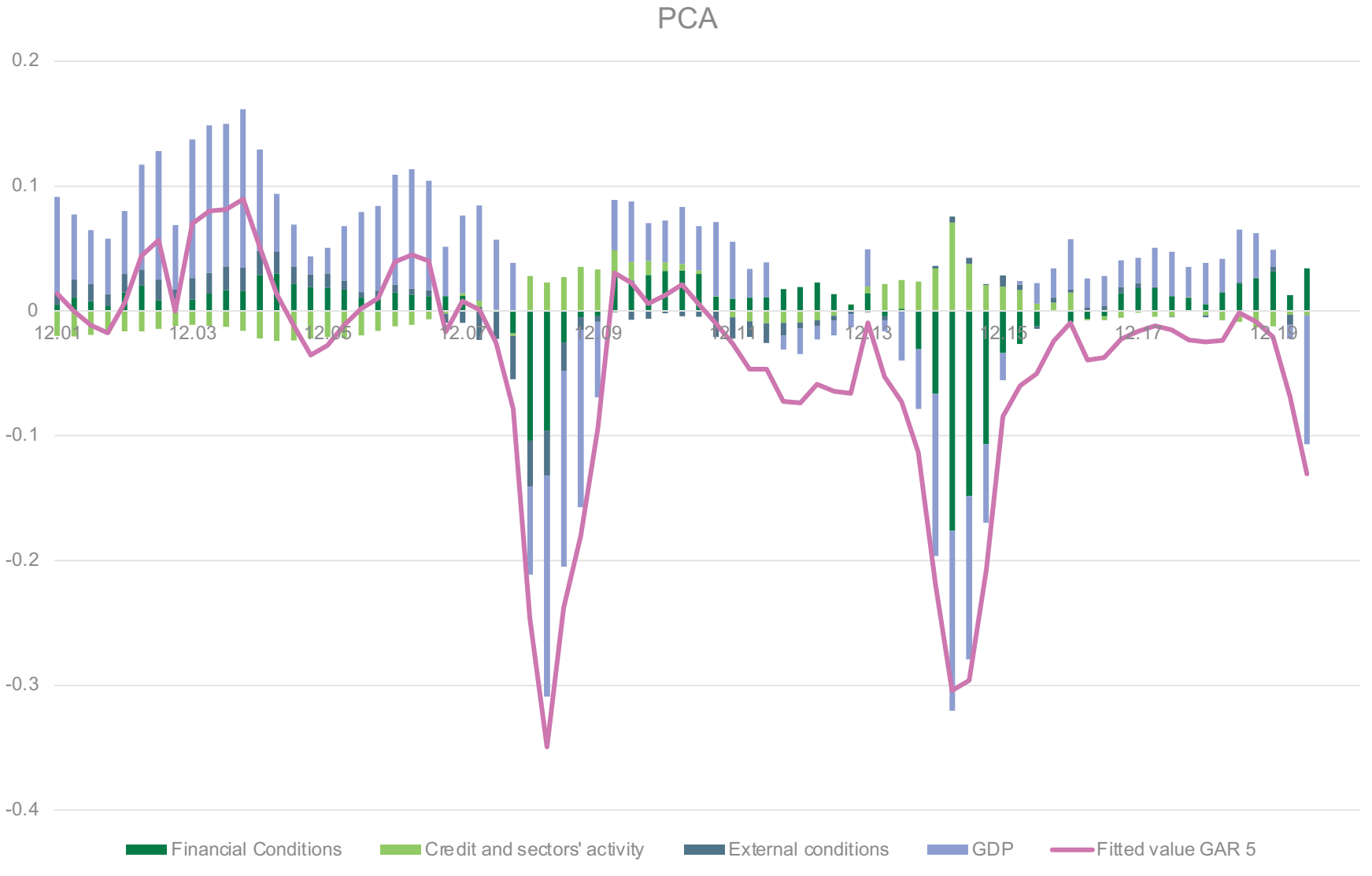
	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q	9Q	10Q	11Q	12Q
fin_cond_pca_sc	-0,008	0,005	0,011	0,008	0,012	0,011	0,008	-0,012	-0,007	-0,008	-0,005	-0,003
credit_sect_pca_sc	0,005	-0,007	-0,009	-0,022	-0,015	-0,01	-0,0005	0,028	0,025	0,022	0,017	0,021
external_pca_sc	-0,003	-0,012	-0,015	-0,01	-0,018	-0,02	-0,02	-0,005	0,008	-0,001	-0,001	-0,003
GDP_yoy2	0,904	0,378	0,321	-0,579	0,047	0,047	0,206	-0,229	0,176	-0,053	-0,01	0,394

Comparison of fitted values

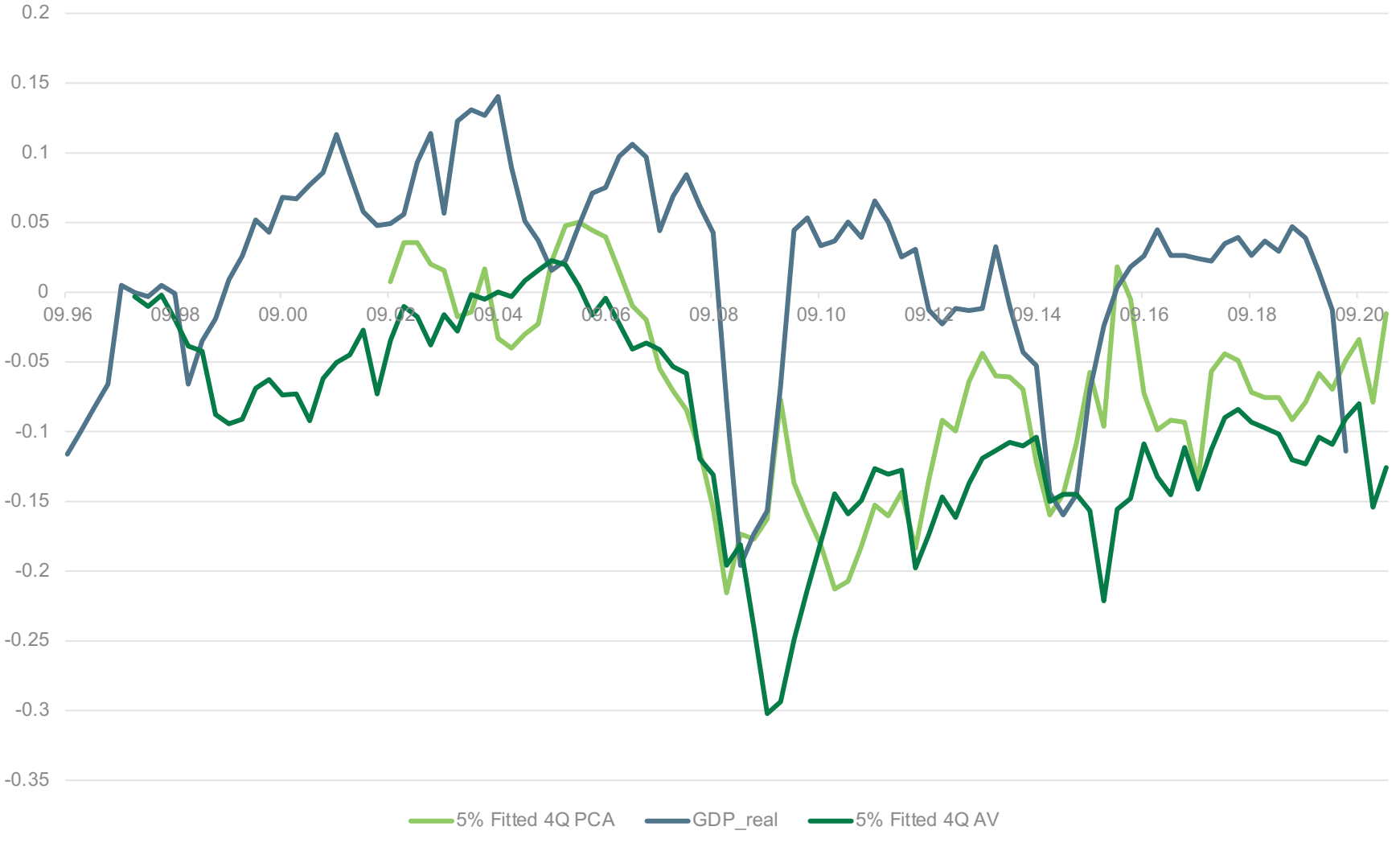
Distribution of factors



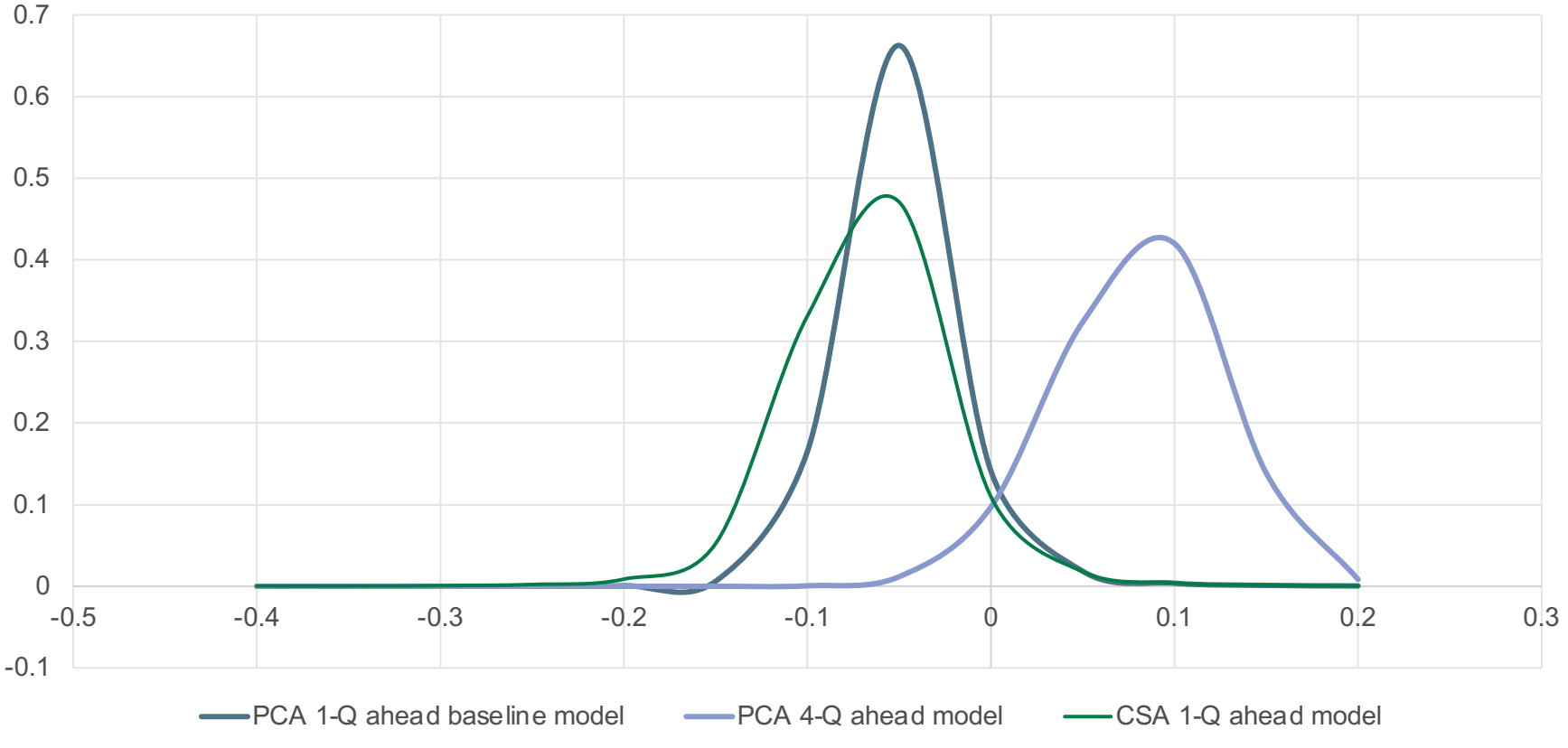
Distribution of factors



Fitted values 4Q ahead

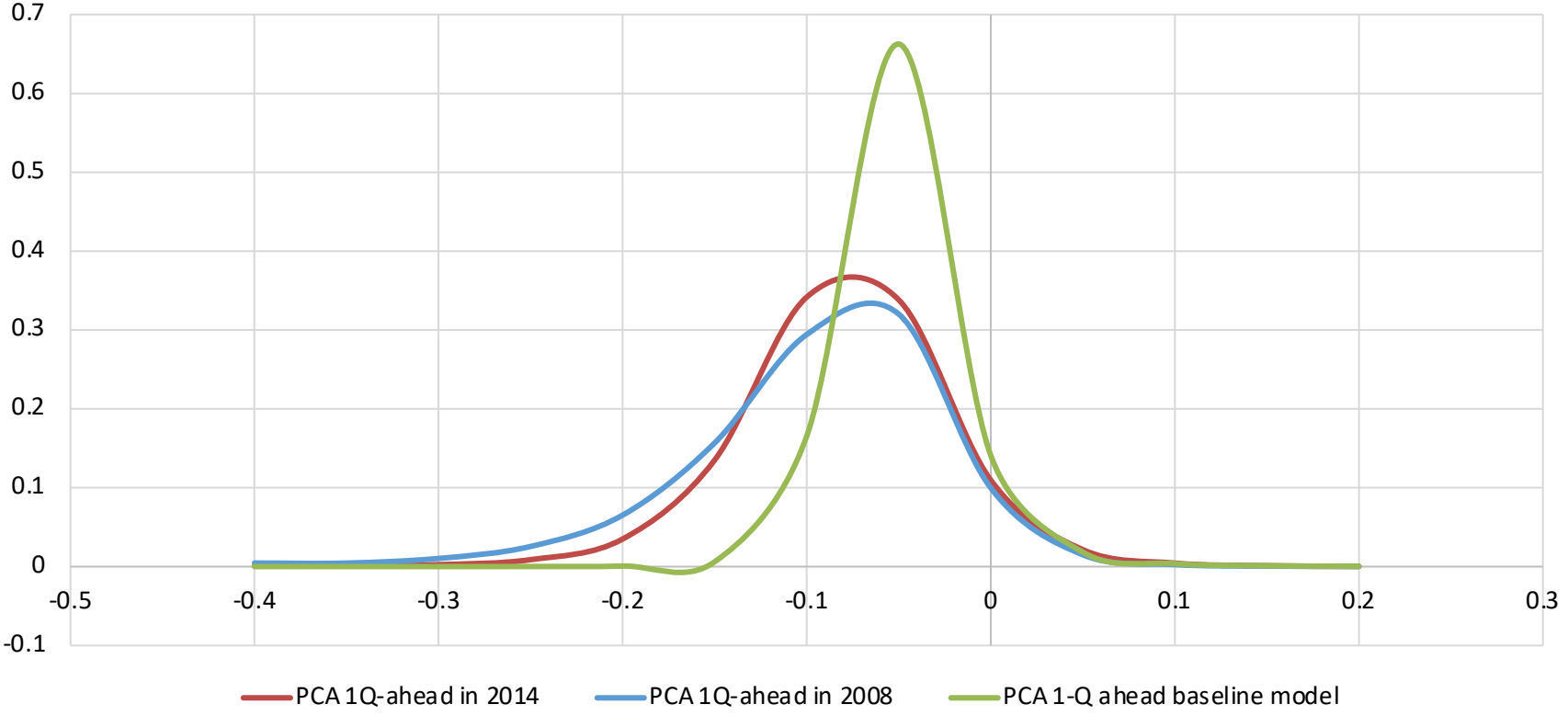


Distributions



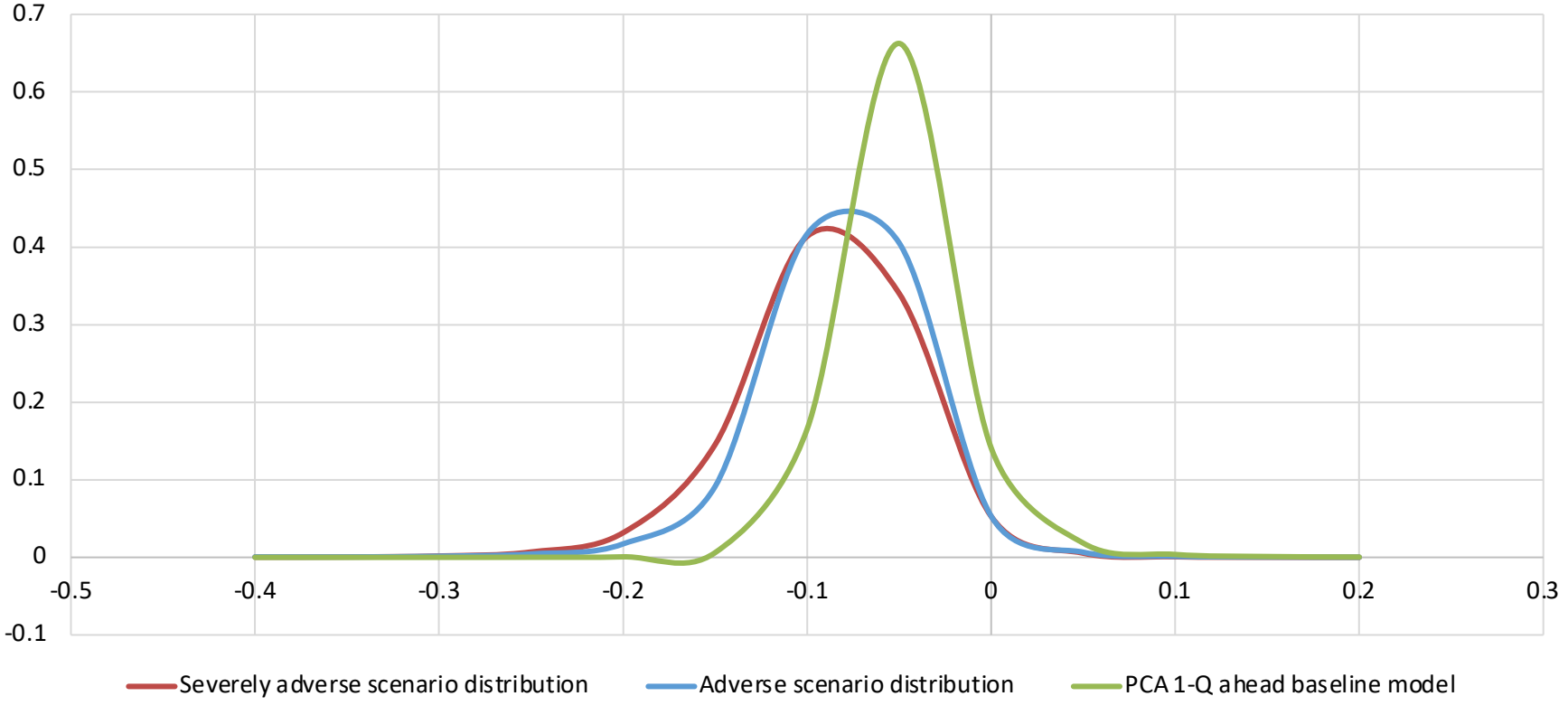
	PCA 1q ahead	PCA 4q ahead	CSA 1q ahead
GaR, 5%	-11.8%	-2.1%	-15.7%

Distributions within crises



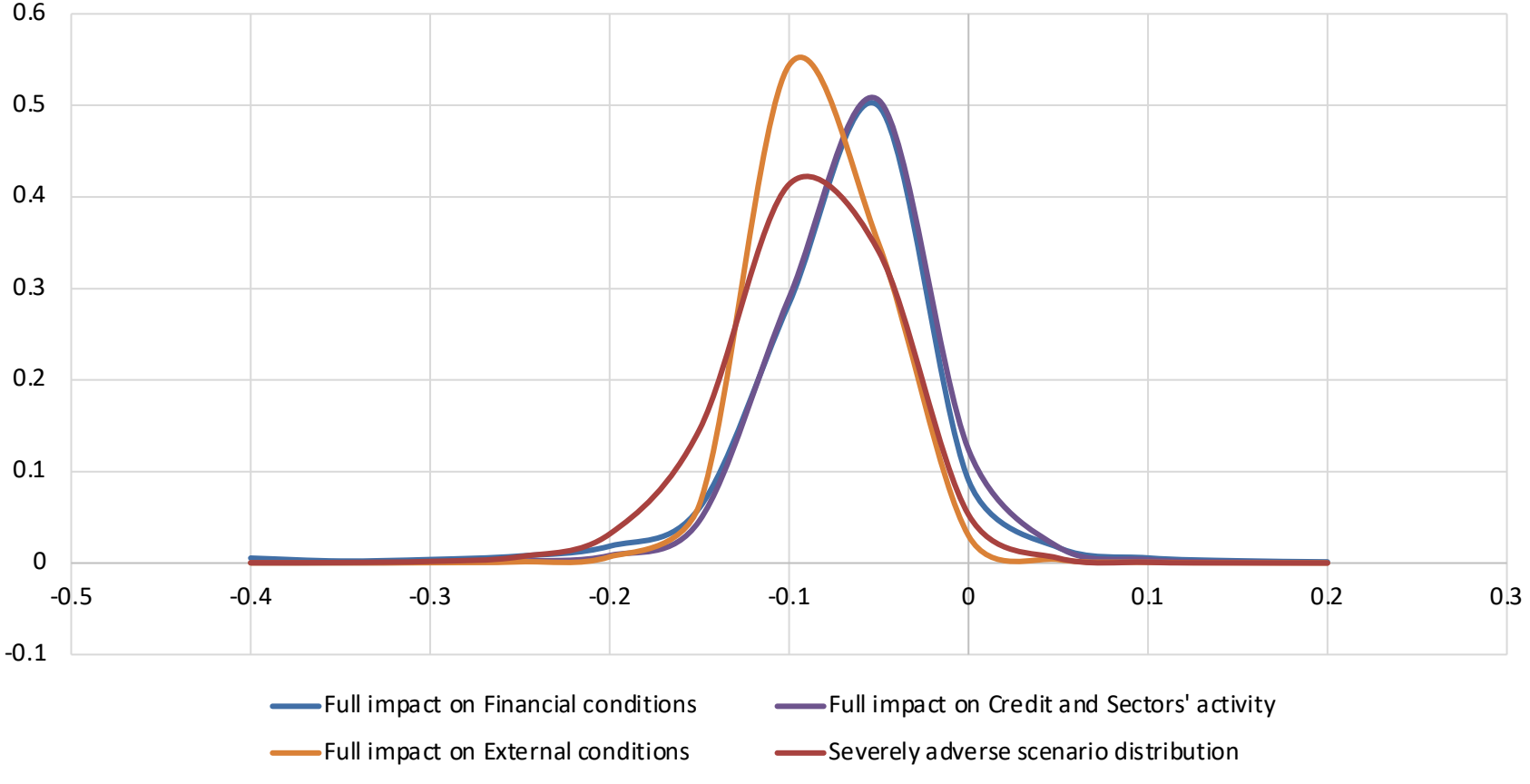
	2008	2014
GaR, 5%	-24.4%	-19.9%

Scenario analysis



	Adverse, 1.5 st.dev.	Severely Adverse, 2 st.dev.
GaR, 5%	-17.6%	-19.4%

Scenario analysis considering correlation



	1Q FinCond	1Q Cred Sect	1Q ExtCond
GaR, 5%	-18.3%	-15.5%	-15.8%

Conclusions

- We applied and adapted GaR framework for Ukraine and explored the association between macrofinancial environment (financial conditions, credit and sectors` activity, and external conditions) and economic activity on different stages of Ukrainian economy.

- The model under PCA outperformed the model under CSA in terms of significance and stability of the coefficients and the predicting power. The results of the PCA model imply the negative relationship between financial conditions and future economic growth. Moreover, the impact of financial conditions is more than twice stronger in terms of magnitude on the lower quantiles.

- According to the fitted conditional GDP growth distribution 1q ahead, there is 5% probability that GDP will fall by at least 11.8% next quarter.

Further work

- Regression results differed depending on the approach of constructing index.
- Combining two model specifications for deriving the GDP growth distribution.