EUROPEAN CENTRAL BANK

EUROSYSTEM

An objective-based approach to limit initial margin procyclicality

22nd Bank of Finland payment and settlement system simulator seminar

Helsinki, 30 August 2024

Rasmus Pank Roulund, Robert Koci and **Francesco Vacirca** (*)

(*) European Central Bank (DG-MIP OVS/SD)

Overview

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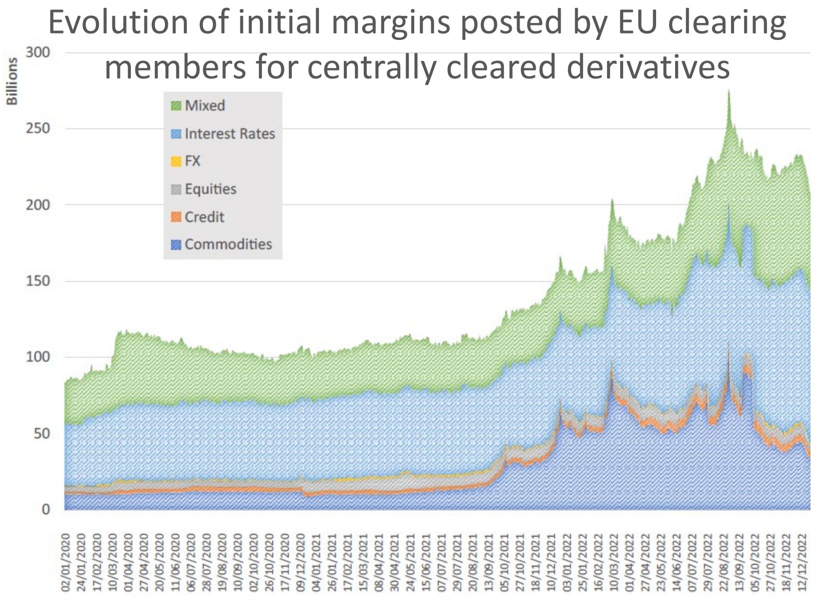
Introduction

CCPs reduce counterparty risk through novation and collecting collateral (initial margins – IMs), but IMs tend to be positively correlated with market stress -> IMs may amplify shocks and lead to destabilizing liquidity spirals

Current anti-procyclicality (APC) tools may not be effective in preventing liquidity shocks:

- Covid-19
- Energy crisis
- GILT crisis



Can an APC tool be effective?

- Collect sufficient IMs
- Limit short-run IM growth
- Not too costly

CCPs margin models - Central Clearing & Margining

EMIR Clearing Obligation

Introduced in the aftermath of the Great Financial Crisis to increase transparency and reduce contagion in case of default

Mandatory clearing of selected “standard” OTC derivatives (e.g., IRS and CDS)

Article 4 of EMIR

What does a CCP do?

The CCP acts as intermediary among its participants (Clearing Members), becoming the buyer to every seller and vice versa.

Margining

The counterparty risk is mitigated by CCPs, by computing and collecting collateral (margins) from its Clearing Members.

Two main types of margin, differentiated by the risk they cover:

Variation Margin

Backward-looking element to off-set current exposure:

- Mark – to – Market
- Computed at contract level and aggregated.

Initial Margin

Forward-looking element to cover potential future exposure in case of counterparty default.

- Computed at Portfolio Level

CCPs margin models - Central Clearing & Margining

Variation Margin are determined by computing the daily mark-to-market value.
Initial Margin model varies among CCPs, commonly composed by three elements:

1 **Historical Market Component:** employs classical risk measures (Value at Risk or Expected Shortfall) over a pre-defined number of observations (look-back period).

2 **Stress Market Component:** as historical market component but computed over a smaller number of pre-defined stress scenarios.

3 **Addons** to cover specific risks (e.g. liquidation and concentration risks).

CCPs margin models - Standard initial margin models

Historical Simulations

Nonparametric model, the risk metric is calculated on the historical series of returns.

Drawback of Historical Simulation

Simple to construct and understand but lack volatility modelling.

Importance of Volatility

Current market volatility affects returns in the immediate future.

Solution (Filtered Historical Simulations – FHS)

- **Scale the historical returns with current volatility.**
- Estimate volatility using a model that allows for weighting, e.g., Exponential Weighted Moving Average (EWMA).

How does filtering work?

1. Estimate the volatility.
2. Devolatize historical returns.
3. Revolatize the returns using the volatility estimate for the day of the risk metric calculation.

CCPs margin models – initial margin simulator

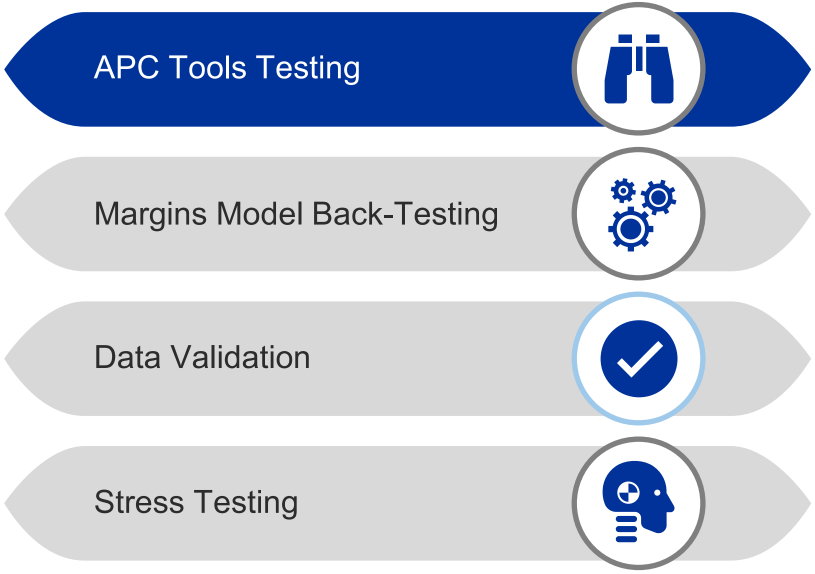
Simulator

"Standard" initial margin simulator to support CCPs oversight and ECB policy stance:

- Highly customizable
- Multi – purposed

parameters

- **λ:** Decay parameter for the EMWA.
- **Lookback Period**: number of historical dates per scenario.
- **MPOR**: Margin Period of Risk (minimum set by EMIR)
- **Filtering:** Enable, or not, historical returns filtering.
- **Confidence level:** for the Risk Metrics (minimum set by EMIR)
- **Scaling parameter:** value used to scale up the risk metric to a higher confidence interval.
- **Risk metric**: Value at Risk or Expected Shortfall



CCPs margin models – Example of initial margin computation for a future contract

- P_t: daily prices for Dutch TTF futures
- Returns over MPOR: $r_t = \log \Delta^{MPOR} P_t$ (MPOR = 1)
- EWMA volatility

$$\sigma_0^2 = \frac{1}{n-1} \sum_{t=0}^{T} (r_t - \bar{r}_T)^2$$

$$\sigma_t^2 = \lambda \sigma_{t-1}^2 + (1-\lambda) r_t^2, \quad t > T$$

- Devolatilized return: $\rho_t = r_t / \sigma_t$
- Revolitized (relative to T) return $\sigma_T \rho_t$

Calculate initial margins for day t with lookback π and risk tolerance α

- Scenarios: $x_t = (\sigma_t \rho_{t-\pi}, \dots, \sigma_t \rho_{t-1})$

Initial margins calculated as VaR or ES

- $\mathrm{VaR}(x_t; \alpha) = x_{t,[(1-\alpha)\pi]}$
- $\mathrm{ES}(x_t; \alpha) = \sum_{i=0}^{[(1-\alpha)\pi]} x_i / [(1-\alpha)\pi]$
- $\mathrm{IM}_t^{baseline} = \mathrm{VaR}(x_t; \alpha = 0.99)$

"Standard" APC tools (1/2)

EU secondary legislation defines three APC tools:

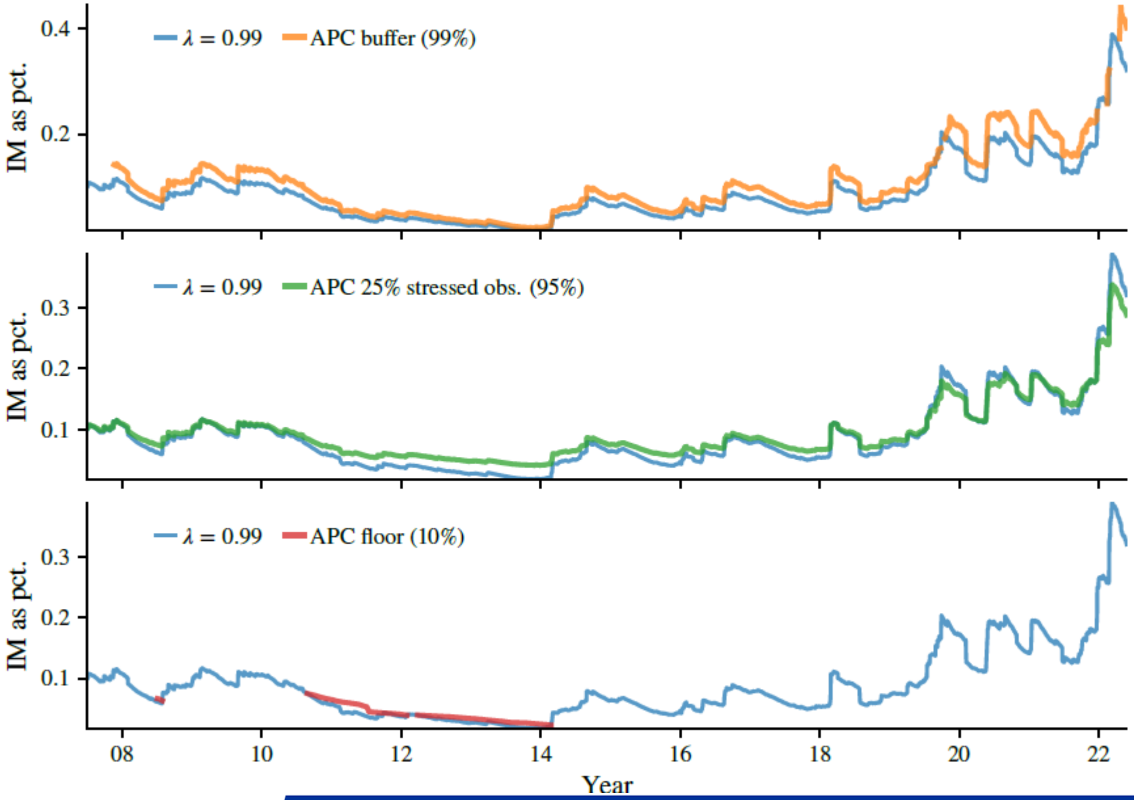
- APC tool 1: apply a margin buffer at least equal to 25% of the calculated margins which it allows to be temporarily exhausted in periods where calculated margin requirements are rising significantly;
- APC tool 2: assign at least 25% weight to stressed observations in the lookback period
- APC tool 3: ensure that its margin requirements are not lower than those that would be calculated using volatility estimated over a 10-year historical lookback period.

$$\mathrm{IM}_t^{\mathrm{buffer}} = \begin{cases} 1.25\mathrm{IM}_t^{\mathrm{baseline}} & \text{if } \mathrm{IM}_t^{\mathrm{baseline}} < \mathrm{IM}_{q\%,t}^{\mathrm{baseline}} \\ \mathrm{IM}_t^{\mathrm{baseline}} & \text{otherwise} \end{cases}$$

$$\mathrm{IM}_t^{\mathrm{stressed}} = \frac{3}{4}\mathrm{IM}_t^{\mathrm{baseline}} + \frac{1}{4}\mathrm{IM}_{q\%,t}$$

$$\mathrm{IM}_t^{\mathrm{floor}} = \max\left\{\mathrm{IM}_t, \overline{\mathrm{IM}}_t^{\tau}\right\}$$

"Standard" APC tools (2/2)



"Objective based" APC tool

Current objective are not based on "transparent" objectives, but are solution-based

We define as objective-based APC tool as a tool that attempts to:

1. Safeguard CCPs in line with their risk preference
2. IM increase should not be higher than pre-defined values (if possible)
3. Additional policy costs are evaluated ex-post

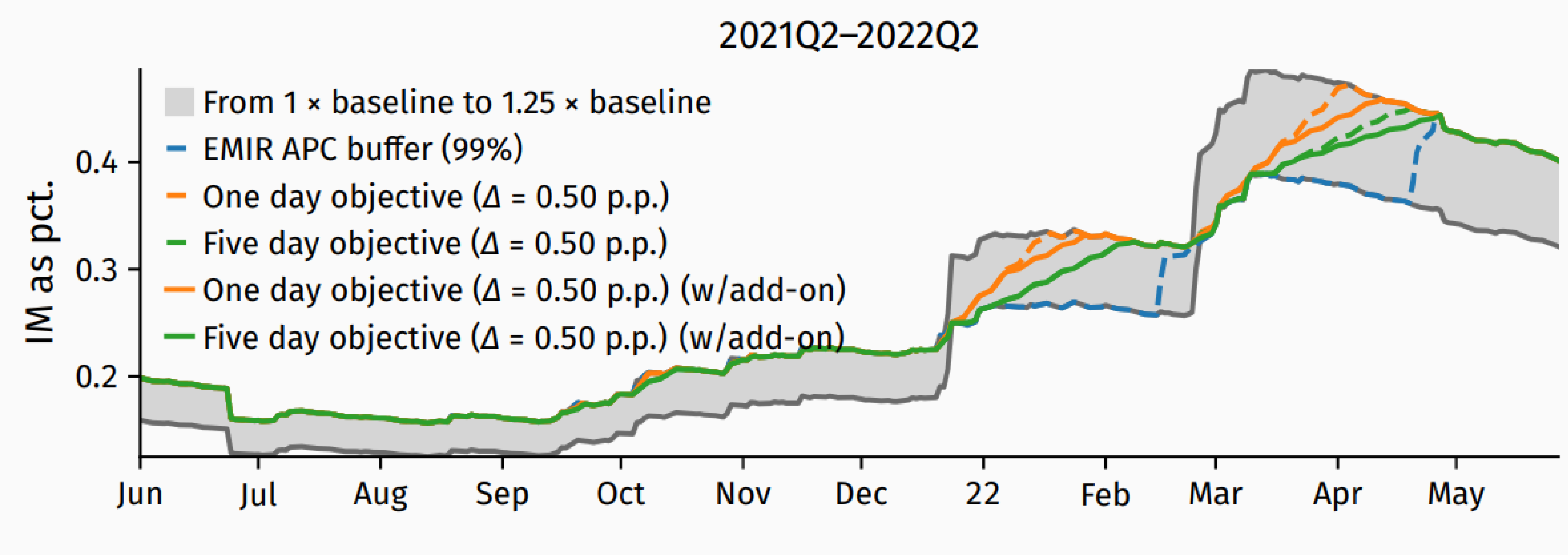
1. $IM_t^{realized} \geq IM_t^{baseline}$ for all t

2. $\Delta IM_t^{realized} \leq \bar{\Delta}_{IM}$ for most t

One-day objective based on buffer APC tool →

$$IM_t^{realized} = \begin{cases} 1.25 IM_t^{baseline} & \text{if } 1.25 IM_t^{baseline} < IM_{t-1}^{realized} + \bar{\Delta}_{IM} \\ IM_{t-1}^{realized} + \bar{\Delta}_{IM} & \text{if } IM_t^{baseline} \leq IM_{t-1}^{realized} + \bar{\Delta}_{IM} < 1.25 IM_t^{baseline} \\ IM_t^{baseline} & \text{otherwise} \end{cases}$$

“Objective based” APC tool



Results - Performance metrics

Standard performance metrics

- Breaches $BR(x_t) = \frac{1}{t}\sum_{\tau=1}^{t} \mathbf{1}\{\mathrm{IM}_{\tau-1}^{\mathrm{realized}} - r_\tau < 0\}$
- Average costs $AC_t = \frac{1}{t}\sum_{\tau=1}^{t} \mathrm{IM}_t^{\mathrm{realized}}$

APC performance metrics

- Peak-to-trough: $PT_t = \mathrm{IM}_{99.7\%,t}^{\mathrm{realized}} / \mathrm{IM}_{0.3\%,t}^{\mathrm{realized}}$.
- Large calls: $LC_t = \max_{p,q}\left\{\mathrm{IM}_{t-p}^{\mathrm{realized}} - \mathrm{IM}_{t-q}^{\mathrm{realized}}\right\}$ for all $\{p, q:\ 0 \le p \le 20; 1 \le q < p\}$.
  $LC = LC_{99.7\%,T}$
- High IM growth: $HG_t = \frac{1}{t}\sum \mathbf{1}\{\Delta\mathrm{IM}_t^{\mathrm{realized}} > \bar{\Delta}_{\mathrm{IM}}\}$
- Procyclicality breaches:
  $PB_t = \frac{1}{t}\sum_{\tau=1}^{t} \mathbf{1}\{\mathrm{IM}_\tau^{\mathrm{realized}} \equiv \mathrm{IM}_\tau^{\mathrm{baseline}} \wedge \mathrm{IM}_{\tau-1}^{\mathrm{realized}} \neq \mathrm{IM}_{\tau-1}^{\mathrm{baseline}}\}$

Results - Standard performance metrics

	n			*BR* [%]			*AC* [%]		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Baseline (0.99%)	3811	3448	363	0.73	0.70	1.10	8.69	7.41	20.87
EMIR buffer (99.0%)	3711	3348	363	0.35	0.30	0.83	10.56	9.07	24.33
EMIR stress (95.0%)	3811	3448	363	0.45	0.38	1.10	9.47	8.34	20.19
EMIR floor (10.0%)	3561	3198	363	0.62	0.56	1.10	8.82	7.45	20.87
One day obj. (0.5 pp.)	3811	3448	363	0.37	0.32	0.83	10.76	9.22	25.38
One day obj. (w/add-on)	3811	3448	363	0.37	0.32	0.83	10.75	9.22	25.26
Five days obj. (0.5 pp.)	3811	3448	363	0.37	0.32	0.83	10.68	9.19	24.88
Five days obj. (w/add-on)	3811	3448	363	0.37	0.32	0.83	10.67	9.18	24.81

Results - APC performance metrics

	PB [%]			*HG* [%]			*PT* [Ratio]			*LC* [%]		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Baseline (0.99%)				1.63	1.25	5.25	19.62	10.38	3.07	10.80	7.90	13.26
EMIR buffer (99.0%)				1.83	1.20	7.73	17.27	10.05	2.73	9.65	9.52	13.20
EMIR stress (95.0%)				1.31	0.96	4.70	7.96	4.48	2.42	8.12	6.00	9.97
EMIR floor (10.0%)				1.57	1.16	5.25	14.48	7.57	3.07	10.94	8.15	13.26
One day obj. (0.5 pp.)	0.03	0.03	0.00	0.18	0.15	0.55	18.70	10.19	2.97	9.56	7.35	10.47
One day obj. (w/add-on)	0.03	0.03	0.00	0.18	0.15	0.55	18.34	10.17	2.89	8.89	7.25	9.72
Five days obj. (0.5 pp.)	0.42	0.35	1.10	0.31	0.17	1.66	17.92	10.09	2.84	6.86	6.27	7.86
Five days obj. (w/add-on)	0.45	0.35	1.38	0.31	0.17	1.66	17.57	10.05	2.79	6.84	6.27	7.87

Conclusions and further work

- Objective-based approach to setting initial margins targeting short-term procyclicality ensuring sufficient IM given risk preferences but limiting excessive short-run IM growth
- For a portfolio with one Dutch TTF gas future short-term procyclicality can be lowered by 40% compared to the standard EMIR buffer APC tool
- Average costs are slightly higher than the EMIR buffer APC tool

Future research

- Objective-based approaches for the EMIR stressed observation APC tool
- Extent analysis to cover EMIR data
- Consider other alternative targets or refine targeting mechanism

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